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THE EARTHQUAKE AND VOLCANIC ERUPTION IN GUATEMALA IN 1902.

BY

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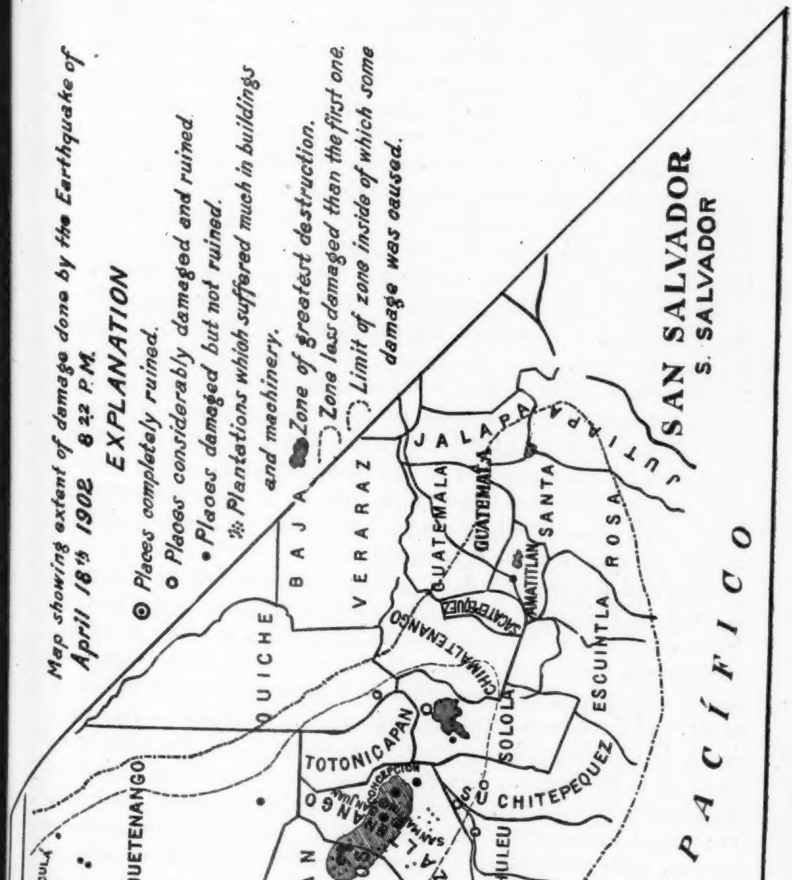
I had just arrived in Huehuetenango the day previous to the earthquake. At half-past eight in the evening of the 18th I was occupied in my room, when, suddenly, the earth began to tremble. I rushed out into the open courtyard, and was immediately joined by everyone in the hotel. The movements lasted three minutes, at first gentle, then increasing to a maximum, then declining. During the night there were smaller shocks, and others next day. These shocks were renewed in the night, and there was one tremor which lasted for fifteen minutes. This was heavy enough to cause the telephone poles to swing perceptibly for that length of time. Standing in the yard and facing the east, I could observe the swaying of our low house, the wall of which was not over 8 feet high. It appeared as if the house stood in a heavy swell of waves. There was heard only a low creaking of walls. The air was filled with dust from the fall of the church tower and a house near by, and much other damage was done. Every house in town was cracked more or less seriously. All the roofs settled, and some fell. The large tower of the Government building, square in shape, about fifty feet high and twenty feet at the base, was greatly injured, the upper part twisted so that it did not stand in line with the lower. The churches were more damaged than other buildings.

The effect of the earthquake was felt over the whole of Central America, but especially in Guatemala, Salvador, and the southern half of Mexico. The centre of destruction seems to have been in the vicinity of Quezaltenango, extending towards San Marcos. The general opinion was and is that the wave of disturbance came

from the ocean, and that the centre of the earthquake lay some hundreds of miles out in the sea. There is really nothing to indicate that the wave came from the ocean, but every reason to presume that its centre was near the centre of the greatest disturbance—that is, between Quezaltenango and San Marcos.

I visited nearly all the places which had been greatly injured. The first reports were that the towns of the western part of Guatemala had all been destroyed. There were only two larger places totally destroyed—Quezaltenango and San Marcos, and, with these, the little villages situated between them. In Quezaltenango about one-half of the houses were ruined beyond repair. These houses were situated in the lower part of the city. The upper part was less injured. All the tall buildings, with the exception of two, were so injured as to be useless, or at least dangerous. The majority of large buildings, of two or more stories, were thrown down. In many the upper story fell, while the lower remained. I was informed that only 260 persons were killed in Quezaltenango, and that altogether only some five hundred persons had been killed; but it is probable that at least 1,500 were killed in the Republic by the first shock.

In San Marcos the destruction was, if possible, greater. In the smaller villages, where the houses are made of adobe and straw, only the former were injured. All the churches in those villages, in the vicinity of San Marcos and Quezaltenango, were thrown down, only a few walls or parts of wall remaining. This destruction to churches extended over a large part of Guatemala, but especially in the western and northwestern part. There were some exceptions. For instance, in Totonicapan little damage was done. This was also the case in Quiché, where not even a house, church, or Government building was injured. But in Santo Tomas Chichecastenango, situated near Totonicapan and Quiché, the church was practically destroyed, while the adobe houses were injured by cracking. Even in the northern part of Huehuetenango district the churches were injured or destroyed, as, for instance, in San Martin, Soloma, etc. But as we go further north the damage was less. Salcachá is situated only two leagues from Quezaltenango, but it remained uninjured. The comandante telegraphed to the President that the town had been totally destroyed; but I failed to find a single house that had suffered seriously, and even the church was only slightly injured. This town lies on perfectly low and level ground along the same stream which flows by Quezaltenango. The other uninjured towns, I found, were all situated on table or


Map showing extent of damage done by the Earthquake of
April 18th 1902 8 22 P.M.
EXPLANATION
Places completely ruined.
Places considerably damaged and ruined.
Places damaged but not ruined.
Plantations which suffered much in buildings and machinery.
Zone of greatest destruction.
Zone less damaged than the first one.
Limit of zone inside of which some damage was caused.
HUEHUETENANGO
CHACULA
QUICHE
BAJA
VERARAZ
TOTONICAPAN
SAN MARCOS
QUEZALTENANGO
RETALHULEU
SUCHITEPEQUEZ
SOLOLA
CHIMALTENANGO
SACATEPEQUEZ
GUATEMALA
AMATITLAN
ESCUINTLA
SANTA ROSA
JALAPA
JUTIAPA
TAPACHULA
SAN SALVADOR
S. SALVADOR
OCÉANO PACÍFICO

mesa lands, surrounded by deep barrancas or gorges, cut out by creeks or rivers. When these deep gorges were situated between the town and the earthquake centre the town had not suffered. But when, as in the case of Santo Tomas Chichecastenango, there were no barrancas to separate the houses from the earthquake centre, then destruction had taken place. This theory seemed to hold good in every instance, except as regards Salcachá. Thus Sololá was greatly injured; while Panajachel and the other villages on the Lake Atitlan were uninjured, except Santo Tomas, the latter being the only village on the lake which was not separated or protected by a channel in the direction of the greatest disturbance.

The earthquake wave seemed to have a rotary motion. Thus the stones which composed the pillars of the church in Quezaltenango and the stones of some of the pyramidal monuments in the churchyard were twisted in different directions.

On the coast the earthquake caused much damage, but not as great destruction as on the high lands. Thus, almost every coffee plantation had its machinery more or less damaged. Many houses were thrown down, and the cities San Felipe and Mazatenango suffered greatly. The map has been made for the purpose of illustrating the effects of the earthquake.

Much of the damage done to the houses is due to the poor manner of building. The stone used in Quezaltenango is very friable, and can be crushed between the fingers or under the foot. It does not harden with age. It is an andesite rock containing much hornblende, and resembles in texture a very friable sandstone. If the houses had been built of this stone exclusively very much less damage would have been done. But the manner of building is surprising. The stone is in thin slabs, about 18 inches by 6 inches by 8 inches. These stones, which are cut with a knife, are placed on end about three feet apart. In this way two narrow parallel walls are formed. The space between these walls is filled in with mud, pieces of rock, old bricks, etc. This structure then makes up the wall of the new house. The wonder is, not that such walls were thrown down by an earthquake, but that they could support themselves. The only two houses in Quezaltenango which were not injured were built solidly of the same stone. These two houses did not even show a crack from the outside.

I was told that the earthquake opened the ground in many places on the coast. I failed to find such cracks. But on the road from Zuñil to San Felipe a large part of a barranca wall was tumbled down and blocked the road for a long time. On the steep side of

the Volcan de Fuego parts of the cliffs fell along the steep barrancas. I counted some sixty places from below where large parts of the walls had been made to shed their surface covering. In one place a deep barranca had been opened, and vapours were streaming out from the interior of the volcano.

Atmospheric Phenomena accompanying the Earthquake.

There can be no doubt that the earthquake had something to do with the eruption of Santa Maria. The effects of the eruption and the earthquake extended over much of the same territory, and the centres of the two seem to coincide to an extent that could not possibly be accidental. If there had been more towns built of adobe in the vicinity of the crater it is probable that we should have found the greatest destruction of property nearer the volcano than Quezaltenango.

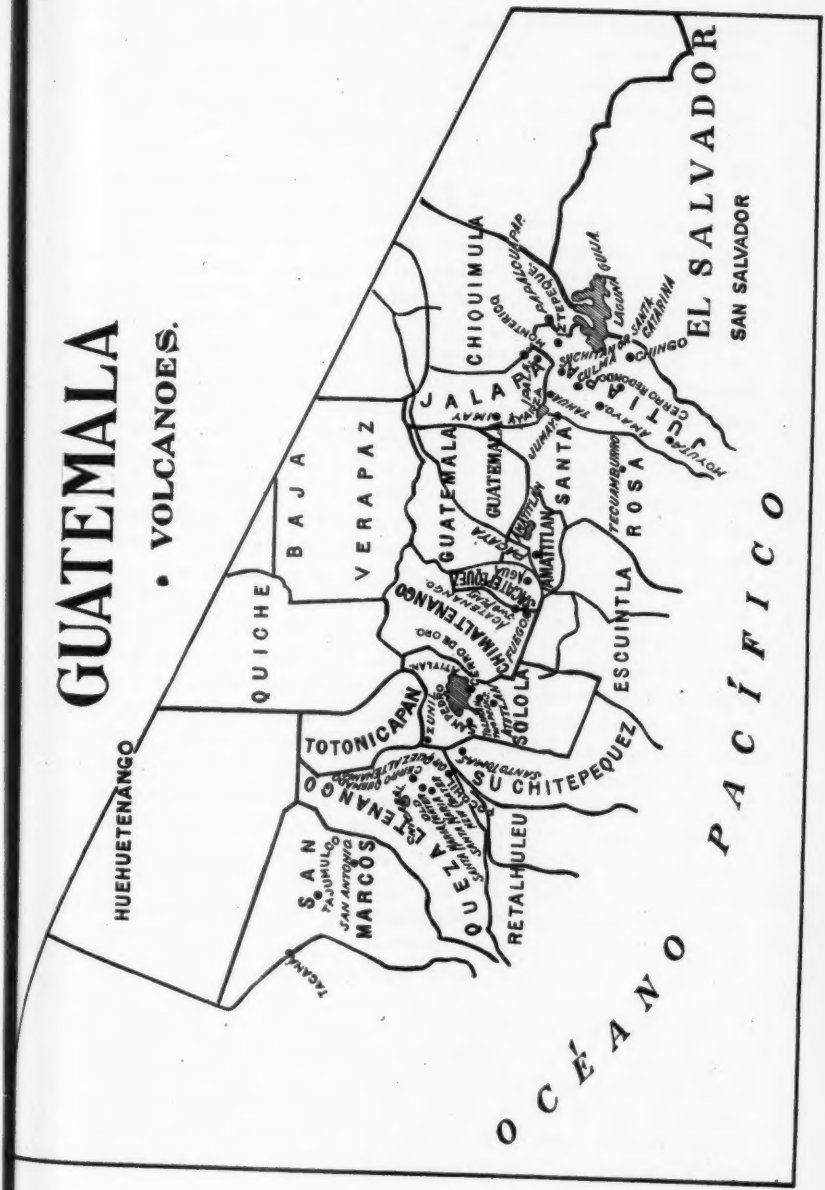
An interesting phenomenon in connection with the earthquake was the sudden cessation of rain. The regular rainy season had already set in some weeks before the earthquake, and for days before there had been rain every afternoon. But the very moment the earthquake took place the sky cleared up and there was no rain for three weeks or so. If this is not a pure coincidence, it will appear as if the earthquake was actually connected with a disturbance in the atmosphere, possibly one of electric nature, the early storms being electrical storms.

If, on the other hand, my observation that the effect of the earthquake was modified by the surface obstruction in the way of barrancas or gorges is not the result of coincidence, then it would show that in this instance, as in many others, the earthquake movement had been confined to the surface of the ground, and that it might possibly have originated through some electrical disturbance near the surface of the earth.

The Volcanoes.

The volcanic rocks in Guatemala appear to be comparatively recent, probably not later than the Cretaceous period; while the majority was ejected during Tertiary times. At the beginning of the eruptive age a large fissure appeared along the Pacific coast on a line now marked by the crest of the cordillera. Outside of this line no volcanic phenomena have left vestiges in Guatemala, as along the north and the northeast side of the Republic no traces are found of recent eruptions, and consequently of no eruptive cones. Beginning close to the boundary of Mexico, the traveller

may observe from the steamer a succession of volcanic peaks, which constitute the most characteristic, as well as the most interesting and beautiful, features of Guatemala. The one situated nearest the Mexican boundary is Tacaná, also known as Soconusco. The next in order to the southeast is Tajumulco, incorrectly called Tajumulto. This volcano, like Tacaná, presents the appearance of several broken cones. Then comes Santa Maria, the Indian name of which is Excanul. The main cone of this beautiful volcano is a perfect pyramid, from whatever side it may be seen. As appendices to this volcano must be considered the smaller eruptive craters of Cerro Quemado and possibly the Zuñil, the latter situated immediately to the southeast, while the former rises on the north side of the main cone of Santa Maria. To the east of Zuñil a smaller and irregular cone bears the name of Santo Tomas; while another in the same vicinity is known as Santa Clara. Immediately south of these volcanoes rises the regular and perfect cone of San Pedro. Next in order, and very close to San Pedro, we see the dominating pyramid of Atitlan, one of the highest volcanoes of Guatemala. On the same base as Atitlan, but hidden from the coast, are two smaller volcanoes, the larger being Toliman, with two peaks, while the smaller is known as Cerro de Oro. The latter, a very diminutive but nevertheless very perfect crater, is situated at the base of Toliman, at the very shore of the Lake Atitlan. Some thirty miles to the southeast we find the highest and most famous of the Guatemala volcanoes. The nearest one is Fuego; while adjoining, on the north side of the latter, lies the even higher Acatenango, the two rising from the same base. Separated from Acatenango by a small valley lies the majestic "Volcan de Agua," the handsomest and most regular of all the volcanoes of Central America. A short distance southeast of Agua we observe the five irregular cones of the volcano Pacaya. By following the main eruptive fissure down the coast we reach finally the volcano Tecuamburro, and further on the volcano Moyuta. The best-known volcano in this vicinity is, however, Chingo, situated on the very boundary of Salvador. All the above volcanoes, except Chingo, are situated on the main fissure, which forms the principal crest of the cordillera. North of the main fissure there exist others, the relative positions of which are not so well defined. On a short side fissure parallel with the main one we find the volcanic cones of Jumay, Cuema, Amayo, and Chingo; while Suchitán, Tahua, Papalcuapa, Iztepeque, Monterico, and Ipala seem grouped along a fissure almost running at right angles with the former. The most inland volcanoes are Imay,


GUATEMALA
• VOLCANOES.
EL SALVADOR
SAN SALVADOR
OCÉANO PACÍFICO
HUEHUETENANGO
QUICHE
BAJA VERAPAZ
CHIQUIMULA
JALAPA
GUATEMALA
SANTA ROSA
ESCUINTLA
SOLOLA
TOTONICAPAN
SUCHITEPEQUEZ
RETALHULEU
SAN MARCOS
QUEZALTENANGO
CHIMALTENANGO
AMATITLAN
IZTAPA
IZABAL
ZACAPA
CHINGO
TACANA

situated about midway between Ipala and the city of Guatemala, and the volcano Ticanlu, which rises about thirty miles to the northeast of Ipala. All the western volcanoes from Tacaná to Agua consist of andesite rock. The eastern group, including Pacaya, consist of basaltic rocks, except Iztepeque, which, according to Rockstroh, is made up of obsidian or volcanic glass.

As volcanic craters we must also consider the large lakes situated immediately north of the main fissure. These lakes are, beginning with the most westerly one, Chicabay, Atitlan, Amatitlan, Ayarza, and Guija, the last partly situated in Salvador. What yet remains of the crater walls surrounding these lakes indicates that they once formed part of a chain of craters of basaltic nature, which rose on a fissure of very ancient origin. The width of the fissure was probably about eight or ten miles; while the length extended from the northern boundaries of Guatemala far beyond the borders of Salvador. Of these crater lakes the Atitlan is the one which has best preserved its original nature and form. The side walls of the lake are precipitous, especially on the northern shore, where a narrow band of debris separates the crater wall from the shore-line. The origin of Amatitlan is less apparent, and Dr. Ed. Rockstroh is inclined to consider this lake as having been formed by the rising of the volcano Pacaya. But to my mind the similarity of the two lakes is so great that it is impossible to ascribe them to different origins. Even in Amatitlan we have the precipitous crater walls on the northern sides—walls made up of basaltic rocks, like those of Atitlan. The most important characteristic of these lakes, indicating their volcanic nature, is that we can trace from them ancient lava-flows in the direction from the former summits to the present coast. These lava-flows consist of the same basaltic rocks as the craters of the lakes, and could not possibly have originated from the andesite volcanoes in their present form. This leads us to a consideration of the respective ages of the Guatemala volcanoes and the formation of the fissures.

Altitude of the Volcanoes.

The altitudes of the andesite volcanoes of Guatemala are variously given. In the geographies published in the country these altitudes are greatly overestimated, sometimes by as much as three thousand feet or more. The following list has been prepared from measurements made by the International Railway of Guatemala, by Dr. C. Sapper, by Prof. Eduardo Rockstroh, from measurements

with an aneroid by the author, and from the U. S. Government charts: *

Agua, top	12,988 feet.	Sacatepequez.	I. R.
Agua, crater	12,543 feet.	Sacatepequez.	G. E.
Amayo	3,444 feet.	Jutiapa.	C. S.
San Antonio	8,364 feet.	San Marcos.	C. S.
Atitlan, crater lake	4,425 feet.	Sololá.	G. E.
Atitlan	11,600 feet.	Sololá.	I. R.
Cerro Quemado, top	10,427 feet.	Quezaltenango.	I. R.
Cerro Quemado, crater	10,400 feet.	Quezaltenango.	G. E.
Cerro Redondo	4,155 feet.	Santa Rosa.	C. S.
Culma	3,445 feet.	Jutiapa.	C. S.
Chingo, top	5,840 feet.	Jutiapa.	I. R.
Chingo, crater	5,447 feet.	Jutiapa.	C. S.
Fuego, top	12,603 feet.	Sacatepequez.	U. S. Ch.
Ipala, top	5,477 feet.	Chiquimula.	C. S.
Ipala, crater	4,952 feet.	Chiquimula.	C. S.
Iztepeque, top	4,464 feet.	Jutiapa.	C. S.
Imay	7,216 feet.	Jalapa.	C. S.
Jumay	5,936 feet.	Santa Rosa.	C. S.
Lacandon	9,217 feet.	San Marcos.	I. R.
Santa Maria or Excanul	12,467 feet.	Quezaltenango.	I. R.
Monterico	4,329 feet.	Jalapa.	C. S.
Moyuta	5,525 feet.	Jutiapa.	U. S. Ch.
Moyuta, crater	5,280 feet.	Jutiapa.	C. S.
Papalguapa		Jutiapa.	
Pacaya, top	8,500 feet.	Amatitlan.	I. R.
Pacaya, crater	8,245 feet.	Amatitlan.	C. S.
Pocohol	9,330 feet.	San Marcos.	U. S. Ch.
San Pedro	9,917 feet.	Sololá.	I. R.
Suchitán	6,516 feet.	Jutiapa.	I. R.
Tacaná	13,329 feet.	San Marcos.	I. R.
Tahua		Jutiapa.	
Tajumulco, top	13,800 feet.	San Marcos.	I. R.
Tajumulco, crater	13,288 feet.	San Marcos.	C. S.
Tecuamburro, first top	6,064 feet.	Santa Rosa.	I. R.
Tecuamburro, second top	6,383 feet.	Santa Rosa.	I. R.
Tecuamburro, crater	4,723 feet.	Santa Rosa.	C. S.
Tolimán, southern top	10,341 feet.	Sololá.	I. R.
Tolimán, northern top	10,266 feet.	Sololá.	C. S.
Zuñil, top	11,522 feet.	Quezaltenango.	I. R.

Comparative Age of the Volcanic Fissures and Craters.

The very oldest fissure is undoubtedly the one on which are situated the crater lakes just referred to. It probably opened during the early Tertiary period. The trend of this fissure diverged more towards the east than the present coast-line, ending in the

* The initials indicate the authorities, the names Sololá, Jutiapa, etc., the Departments.

large lake of La Guija. The early craters were of gigantic nature and much larger than the later volcanoes, though inferior to them in height. From these craters flowed large lava rivers, also made up of basaltic rock fluid. The remnants of these basaltic rivers are yet to be seen in the form of numerous fantastically-shaped hills at the base of the present volcanoes, as will be presently mentioned more in detail.

After the first eruptive force of these basaltic craters had spent itself a long period of inactivity followed, during which the coast-line was gradually rising. At the end of this period, probably during the middle Tertiary, a new fissure opened along the south side of the old craters. Along this fissure opened the present andesite volcanoes extending from Tacaná to Agua. Of these more modern craters those situated most inland are, as a rule, the oldest, this being generally the case where two or more craters are situated close together on the same base. Thus we know that Fuego is younger than Acatenango; and it is probable that Atitlan is younger than Tolimán. But Cerro de Oro seems younger than both Atitlan and Tolimán, if we may judge from the preservation of its crater. From the present eruption of the new crater of Santa Maria, the San Antonio, we know that here also the new force has exerted itself towards the Pacific shore-line. Exception to this rule is the modern crater of the volcano of Quezaltenango, generally known as the Cerro Quemado. This crater opened in 1785, and at a time when Santa Maria was considered as an entirely extinct volcano.

Of the first eruptions of basaltic nature, probably from the present lakes of Amatitlan and Atitlan, there yet remain large dikes, which form a prominent part in the Guatemala coast landscape. Rising from the level slope just below the cordillera, at an altitude of about 1,500 feet, we find a series of low, precipitous hills and ridges, which, with their black, castellated rocks, stand out imposingly against the verdant slopes of the volcanoes. At first it would appear as if these ridges formed a more or less continuous belt parallel with the cordillera, but upon a closer examination this is found to be incorrect. We can follow these "peñascos" from the boundary of Mexico to that of Salvador. They rise abruptly from the plain, and are found to be in groups. The crests are often fantastically shaped, and in many instances bare of vegetation on account of their almost perpendicular sides. On the maps of the country these peñascos are nowhere marked, and in order to get a good view of them it is necessary to examine them from some altitude, preferably from the volcanic slopes. It will then be seen that,

instead of being strictly parallel to the cordillera, they actually form with it various angles, and in some instances branch out in a fan-shaped manner from the general summit of the cordillera to the plain below. This is plainly observable as regards the peñascos below Atitlan and Amatitlan, as well as those on the coast of Costa Cuca below Santa Maria and Tajumulco. As these peñascos are made up entirely of basaltic rocks, similar to those forming the walls of the two large crater lakes, etc., the only explanation of their nature is that they are remnants of the old lava-flows from the first basaltic craters in Guatemala. They can be traced from an altitude equal to that of the present crater lakes to a line drawn from below Escuintla to San Felipe—a line running parallel with the cordillera. Below this line these basaltic flows do not seem to have passed; and it is probable that at the time of their flow the ocean reached to their very base, whereas it has now receded some thirty miles below them. It is evident from the great erosion which has taken place that a very long period elapsed between the formation of these peñascos and the rising of the andesite volcanoes. The land had already then been sufficiently eroded to make it impossible for the more recent lava-flows to cover the older basaltic flows, the former simply passing by the latter. Another point of interest is that all the basaltic flows took place towards the present coast, indicating that the present continent had already risen to a great elevation long before the basaltic eruption took place.

Of the age of the eastern volcanoes little is known, and even their exact location is not marked on any map with accuracy. It seems probable that they are intermediate between the old basaltic flows and the andesite volcanoes. The volcano Pacaya seems to belong to both classes. The oldest eruptions of Pacaya consisted of basaltic rocks; while the many modern eruptions in historic times have projected both andesite lava and loose sand and ash.

Of the interior volcanoes grouped in the vicinity of Lake Guija none has been in eruption in modern times.

Eruptions in Historic Times.

According to a list communicated by Dr. Eduardo Rockstroh the historic eruptions are as follows:

YEAR.	NAME.	INTERVAL IN YEARS FROM PREVIOUS ERUPTION.	INTERVAL IN YEARS FROM LAST ERUPTION.
1526.	Fuego		
1565.	Pacaya		39
1581.	Fuego	55	16
1582.	Fuego	1	1
1585.	Fuego	3	3
1586.	Fuego	1	1
1614.	Fuego	28	28
1623.	Fuego	9	9
1651.	Pacaya	86	28
1664.	Pacaya	13	13
1668.	Pacaya	4	4
1671.	Pacaya	3	3
1677.	Pacaya	6	6
1686.	Fuego	63	9
1699.	Fuego	13	13
1705.	Fuego	6	6
1706.	Fuego	1	1
1707.	Fuego	1	1
1710.	Fuego	3	3
1717.	Fuego	7	7
1732.	Fuego	15	15
1737.	Fuego	5	5
1775.	Pacaya	98	38
1785.	Cerro Quemado		10
1799.	Fuego	62	14
1829.	Fuego	30	30
1855.	Tacaná		26
1855.	Fuego	26	0
1856.	Fuego	1	1
1857.	Fuego	1	1
1880.	Fuego	23	23
1902.	Santa Maria		22

It will thus be seen that there has been no great regularity in the eruptions, and that it is impossible to prognosticate, with hope of correctness, from former eruptions to future ones. The activity has been divided between Fuego and Pacaya. The former has during four centuries erupted twenty-two times; while Pacaya comes next in order with seven eruptions. The other three volcanoes mentioned have each but one. The following are the intervals in years between the eruptions of Fuego since 1526: 1, 3, 1, 28, 9, 63, 13, 6, 1, 1, 3, 7, 15, 5, 62, 30, 26, 1, 1, 23. Of Pacaya, the intervals have been similarly as follows: 86, 13, 4, 3, 6, 98.

If we consider the eruptions as a whole we find that the long periods of inactivity of both Fuego and Pacaya have been broken by eruptions of the one during the inactivity of the other. At no time has there been any interval of inactivity for more than thirty-nine years; while there have been eruptions in consecutive years, and twice two eruptions in the same year. Judging the future by the

past, we may say that we should not expect any period of inactivity to last longer than forty years, and that from six to twelve eruptions may be expected every century. The long periods of inactivity seem to occur about once in a century. It would also appear as if the longer intervals were succeeded by numerous smaller ones. In that case we may during the next few years expect eruptions of some volcanoes, presumably Fuego and Pacaya.

The Eruption of Santa Maria.

The 24th of October, 1902, I had just arrived at Rabinal. During the night I was awakened by what I considered to be heavy cannonading or firing of bombs. As there was to be the "Fiesta de Minerva" celebrated simultaneously in all towns and villages in Guatemala the following day but one, I naturally presumed that the festivities had begun. When I arose at daybreak I was informed that the celebration had not commenced; that the general opinion seemed to be that the cannonading proceeded from the city of Guatemala. The first outburst of the supposed firing was heard by myself about eleven o'clock at night between Friday and Saturday, October 24th and 25th. Towards morning the explosions increased in force, and continued all through the day with intervals of from one to ten minutes. Towards evening the explosions had become more loud and more frequent, and, beginning with 4.30 P.M. and continuing towards 6.30, the noise was intense and the explosions almost continuous. Already in the morning I was satisfied that one of the volcanoes had erupted, and I accordingly forwarded a telegram to my agent in Guatemala City to find out which one. The answer came only towards evening, being a negative one, as the Government prevented the circulation of news. In the forenoon I ascended the highest hill near the town, hoping to see something. The noise from the explosions was here more intense than in the valley, and the ground trembled at every detonation, when towards sunset the explosions increased in violence and it seemed as if the hill on which I stood was ready to burst. At times I had to lay hold on the rocks in order not to be thrown down, and I descended shortly after dark.

As, however, the trembling of the ground was so much less below I became satisfied that an eruption had taken place from one of the volcanoes near Quezaltenango, probably El Zuñil. Santa Maria itself had never been in eruption, and Cerro Quemado had not shown any life for one hundred and seventeen years. In the meantime a telegram had been received from the "Supreme Govern-

ment" stating that one of the volcanoes "in Mexico" had broken out and that there was no cause for alarm. This statement was not believed by any one, as the explosions came from an entirely different direction. I started the following day for Quezaltenango, but the mountain roads had become impassable through washouts [it was the middle of the rainy season], and I had to take the roundabout way over Salamá and Chimaltenango, instead of the more direct one over the mountains and Quiché. Already next day I could see from a high mountain top the immense columns of smoke, and I was able to determine that the eruption was near Santa Maria. The top of this volcano stood out against the clouds, and I presumed that the smoke issued from the mountain known as Siete Orejas, which, however, was not the case. Through one delay or the other I did not arrive in the vicinity of Santa Maria for several days. It was impossible to proceed down the coast, and I had to return to Guatemala and take the steamer to Retalhuleu in order to visit the coast region destroyed, or greatly injured, by the eruption. The following account is based upon my own observations, but I have incorporated some accounts given by one or two friends who happened to be near the volcano during the first few days of eruption.

The 24th of October, 1902, at 6.30 in the afternoon, there were suddenly heard all over Guatemala, Salvador, and the southern part of Mexico and Yucatán heavy *retumbos*, or underground explosions, so common in volcanic countries. In Mexico these *retumbos* were heard as far as Tehuantepec. In Guatemala they were heard all over the Republic, and in Flores, the capital of the Department of Peten, they sounded like heavy cannonading in the direction of Guatemala. The distance to which the sound of the explosions reached appears to have been about 400 miles, more or less. Every explosion caused heavy tremblings of the ground for at least 250 miles from the centre of the disturbance, and this trembling was much greater in the higher elevations than in the lower ones. While thus distinct on the lower plains around Salamá and Rabinal they became alarming when one ascended any of the surrounding hills. But even in the immediate vicinity of the volcano these tremblings did not take the form of earthquakes, and no damage was caused from them alone. They occurred after every explosion, and seemed to travel as fast as the explosion itself. It could be distinctly felt that they came from the same direction as the sound while one was upon the plain, but on the top of the hills the trembling movement seemed to come from the opposite direction or from beneath the ground. In the vicinity of Santa Maria these *re-*

tumbos were intensified and re-echoed from the volcano Tajumulco, so that it was almost impossible to decide upon their origin. At the time of the first *retumbos* Santa Maria was covered by a dense mantle of clouds, which was mistaken for the usual bank of rain-clouds. At about 2 A.M. on the morning of October 25th the trembling of the ground suddenly increased to such an extent that few people remained in their beds.

In Quezaltenango, situated on the northern side of Santa Maria, it was impossible to decide upon the direction of the *retumbos*, nor could any phenomenon of light be observed; but on the west side of the mountain one could clearly see, six miles away, flashes of light. These flashes of lightning extended as far as Tajumulco, and it appeared as if both volcanoes were in eruption. Later in the night, when these flashes were also seen in Quezaltenango, it seemed as if they came from the mountain known as Siete Orejas. For more than a week the people in the vicinity of the new crater did not know its location; and in the city of Guatemala, as well in the Republic generally, the place of the new crater was not known for several weeks.

At midnight, October 24–25, the obscurity caused by the cloud from Santa Maria to Tajumulco became intense, and at about 2 A.M. a fine ash began to fall over the district surrounding Santa Maria. About 9 A.M., on October 25th, the ashes changed into heavy sand of a grayish-white colour, this fall being much heavier in some places than in others. At daybreak, the 25th, there was absolutely no sign of daylight, and for a distance of 25 miles to the north, west, and south of the volcano it was necessary to use candle-light throughout that and several of the following days. With the evening of the 25th the *retumbos* diminished in frequency and intensity, and after this time they could not be heard for more than about 100 miles from the volcano. The rain of sand continued for about thirty hours, and was succeeded by a fall of mud. This began early October 26th, and continued until 6 P.M. the same day. This fall of mud did not extend as far as the fall of sand and ashes, but confined itself to a radius of 12 miles in every direction. After the fall of mud had subsided, the fall of fine sand, or rather ashes, continued throughout the days of 26, 27, 28. In the evening of the 28th the light of day began to appear, and the sky cleared to such an extent that during the night some stars became visible. On October 30th the sun could be seen through the reddish clouds of smoke, and, at the same time, it became possible to observe the eruption of smoke-clouds from the new crater. It was then seen

that, though the eruption had diminished, enormous clouds of smoke and vapour ascended to a height of about 10,000 feet above the crater and masses of ashes were thrown out about 15 miles to the west. As late as November 8th ashes fell over a district about 20 miles to the west and southwest; but the fall was light, and no further damage was then done.

During all this time the *retumbos* continued, but at longer and longer intervals, both day and night. At the end of November they had become rarer, but were heard every day. When I left Aurora, about five miles from the crater, on November 1, the noises were yet loud enough to cause much alarm, and every one was fearing a new eruption.

The electric phenomena accompanying the eruption of Santa Maria were most marked. On the 25th October, from 12 noon to 5 P.M., a sudden and most terrific hurricane swept the vicinity of Santa Maria, extending from several miles southeast of the volcano to several hundred miles west and southwest. During this time the lightning struck the ground continually, and, judging from a trip over the country after the eruption had subsided, I am inclined to think that there was not an acre that had not been struck by lightning within the territory swept by the hurricane. How far this extended north and westwards I do not know. But southwards and southwestwards I saw, for fifteen miles from the crater, trees everywhere destroyed by lightning. Branches were twisted and broken, and trunks had fallen to such an extent that progress through the woods was impossible except on foot.

While this tremendous hurricane lasted only four hours it did more damage than all the other phenomena of the eruption. It was during this time that most of the mud fell, and that all the trees for a hundred miles to the west of the volcano were stripped of their leaves.

The direct electric phenomena of the eruption consisted of flashes of lightning. From the clouds above the volcano crater a constant rain of lightning streamed down to the rim of the crater as well as to the tops of the surrounding mountains, especially to Tajumulco. These lightnings were of various colours, varying from red, pink, and violet to greenish blue.

During the night of October 24, and the day of October 25, within a radius of fifteen miles of the volcano, at short and varying intervals, electric flames or prolonged sparks were seen to ascend from the ground into the smoke and ash-filled air. These flashes had the appearance of actual elongated, narrow flames of pale violet

light, at times changing to yellowish. They proceeded from the soil in the streets, or from the open places, and reached ten or more feet in the air. There was no sound and no crackling noise, and most people supposed them to be incandescent gases ascending from the ground. In the *fincas** on the slope of the volcano I was told that when people walked on the verandas of their houses where ashes had fallen electric sparks accompanied by crackling noises would appear between their feet and the ground.

During the first four days of the eruption no view could be had of the rising crater-cloud from the immediate vicinity of the volcano. Only at a distance of forty miles to the north and east could the erupted sand and smoke be seen against the sky. The first view I had of the eruption was on the fourth day, from the hill of Vuelta Grande, and during the night-time. I could then see plainly rising from a smoky sky a dense illuminated cloud, through which flashed lightnings by the dozen in every second. Rising upwards and outwards, in the way water is thrown out of a fountain-jet, there was an almost continuous display of fire balls, which burst and threw out reddish stars.

Two days later I had another opportunity to view the eruption from a distant hill under a clear sky, and in the day. The appearance was then as follows: The peak of Santa Maria was sharply delineated against the sky. To the westward or oceanward of this pyramid rose every few minutes immense masses of globular clouds, like steam and smoke thrown out of a locomotive when it first starts. These clouds rose to a height of 20,000 feet above the crater in three or four seconds. About every five minutes the whole cloud mass was suddenly pushed to the westward, being carried over the lowlands of the coast and, probably, also northwest towards the Mexican boundary. At intervals of from a few seconds to several minutes new globular masses of clouds shot upwards from the crater, reaching the same high altitude in an incredibly short time, only again to be carried towards the ocean in the same way as at first. These cloud-masses were all white, and resembled thunder-clouds. Besides these quickly-ascending clouds there was seen a continuous reddish-yellow stratum resembling smoke, which must have been about one thousand feet in thickness and horizontally spread out at an altitude of about nine thousand feet, or about three thousand feet below the top of Santa Maria. This cloud reached east and west about twenty miles on each side of the crater. This view was had at 9 A.M. At 2 P.M. streaks of what appeared

* Farms or properties.

to be rain descended from the white cumulus clouds which every now and then rose from the crater, but from the red cloud nothing seemed to fall; it remained motionless as a stratum of reddish smoke over the land surrounding the mountain.

At the end of November, or about a month after the first eruption, I had opportunity to watch the daily eruption of clouds from the crater, especially from the hill of Aurora, on the west side of the mountain and about five miles in a direct line from the crater. This view could only be had in daytime, and then only at from 6 to 8 o'clock in the morning, after which hour the sky would cloud up so that neither the pyramid of Santa Maria nor any other part of the cordillera could be seen. Eruptions were observed only during the morning; but the general belief was that the crater erupted regularly twice a day, morning and afternoon. The fact that the volcano could never be seen in the middle of the day and in the afternoon made any reliable observation impossible; and I think it probable that the eruption continued day and night. At intervals of from a few seconds to ten minutes at the longest, columns of white smoke rose with great force from the crater. It could be clearly seen that they came from at least six distinct openings. At times six columns could be seen issuing at the same time, while a few minutes later there might be only one or two columns. At times these columns coalesced at a height of a few hundred feet; at others they remained separated to a height of two or three thousand feet. At a height of about five hundred feet above the crater, part of the issuing clouds separated from the rest, and were gradually carried along the crest of the cordillera up the coast. In this manner was formed a horizontal continuous stratum, a few hundred feet thick, but ten to fifteen miles long, extending principally in one direction, up the coast or northwestwards. The other globular clouds dissolved when reaching an altitude varying from three thousand feet to five or more thousand feet above the crater. Both the rising and the horizontal clouds were of the same whitish hue, only here and there could be seen a yellowish tint in the horizontal cloud. The issuing of the clouds at that late period after the main eruption was not accompanied by retumbos or explosions, but there were heard roaring noises, which made the earth quiver for miles. At intervals of several hours there were regular retumbos, especially in the night-time. Small shocks of earthquake took place every few days. The prevailing winds which carried the clouds away were from east to west.

From the middle to the end of November I made a more

thorough examination of the region along the coast, between Retalhuleu and Santa Maria.

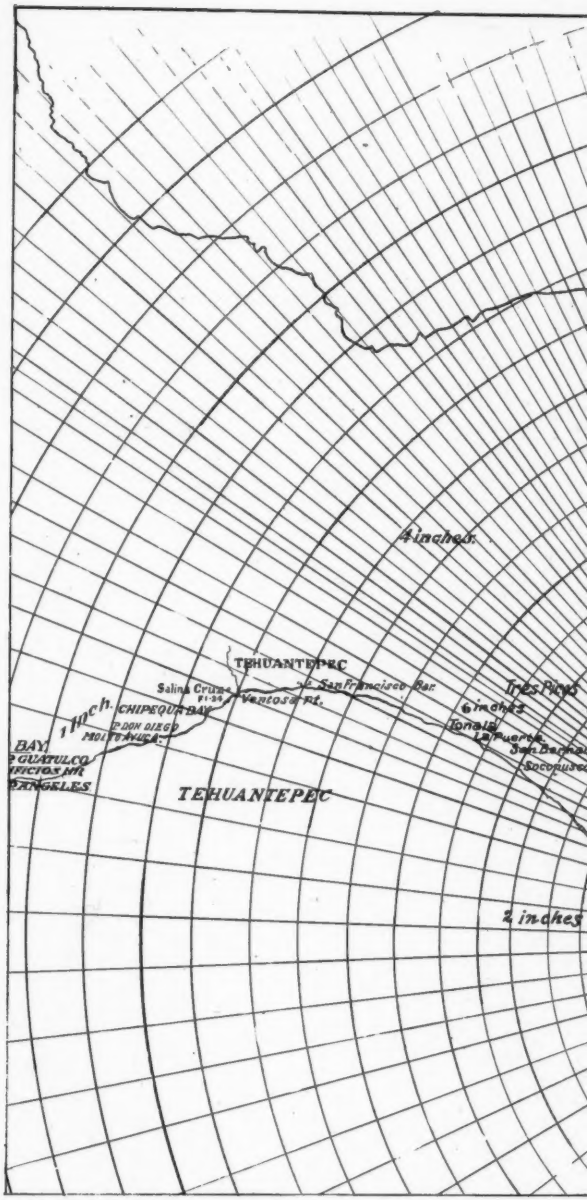
For two weeks after the eruption clouds continually hid the mountain side, but after the worst of the eruptions had ceased it was found that a new crater had opened on the southwest side of Santa Maria at an altitude of about 7,000 feet. The crater is situated immediately below the main top of Santa Maria, on a line drawn between the summit and the nearest point on the coast, and on land belonging to the finca San Antonio, so far as known. The mouth of the crater is an ellipse with the longitudinal axis running almost due east and west for about three thousand feet. The general depth of the crater is about 800 feet; while the deepest part of the crater floor is about 2,000 feet. On this main floor there are seen six funnel-shaped apertures, from which clouds of steam and sulphurous vapours constantly issue. The largest of these fumaroles is situated close to the eastern rim of the crater. It is round, and 100 or 150 feet in diameter. The other fumaroles are near the western rim of the crater. The eastern wall of the crater is nearly vertical, and reaches almost to the very top of Santa Maria. From the sides of the main volcano vast quantities of rocks were constantly falling into the new crater, with a noise resembling thunder. The side thus caving in has a depth of about 6,000 feet, and it so nearly reaches the summit that it seems likely the top cone of Santa Maria will fall into the new crater. If this happens the regular beautiful top will be replaced by two or more broken cones, like those of Pacaya and Tajumulco. Undoubtedly the largest part of the side fell in during the first days of the eruption. What has since fallen forms a cone at the bottom of the crater about 400 feet high and twice as wide. In this cone, resting against the side of the mother volcano, there is situated the sixth fumarole. The deepest part of the crater is towards the east. Towards the centre the crater bottom rises several hundred feet, but sinks again to the westward. All around the crater is a line of rocks about 800 feet wide, the rocks being partly buried, but projecting sometimes sixteen feet above the surface. The upper part of the crater consists of rocks and heavy sand; while the lower part consists mainly of light pumice-stone ash. The inner slopes of the crater form a declivity of about 60 degrees. These notes about the inner appearance of the crater are principally from a memorandum communicated by Mr. Fred. Lenzinger, who, some time after the eruption, visited the crater with two other gentlemen.

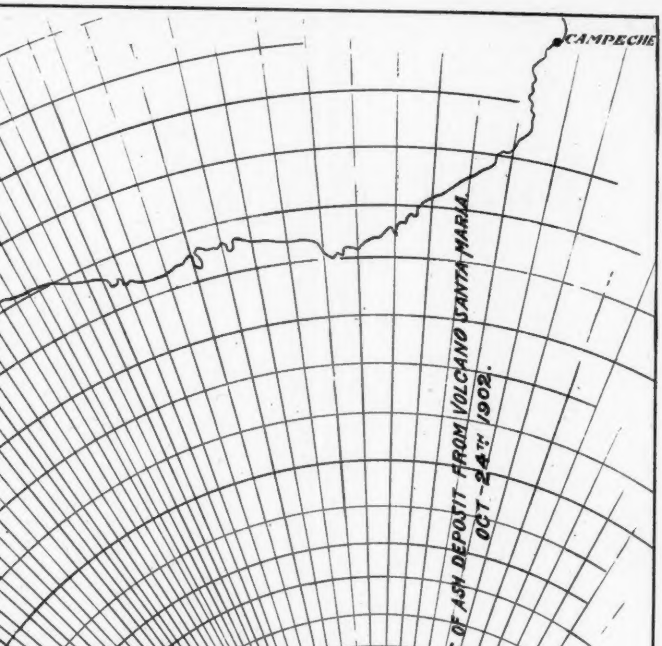
Up to the end of November the new crater had not thrown out

any lava, nor any direct streams of water. The eruption had been exclusively of sand, ashes, mud, steam, and sulphurous and other chemical fumes. During the first four days masses of sand and ash had been thrown out in a direction obliquely towards the west and northwest, or parallel to the main axis of the cordillera. Very little had been thrown to the east and south. I found the whole country covered with a thick mantle of white and gray sand. Of the tropical and impenetrable vegetation which once clothed every inch of ground which had not been previously cleared for plantations nothing was left except bare trunks and branches. As far as the eye could reach, beginning about 25 miles from the shore-line and extending to the very crest of the cordillera, was seen a continuous whitish sheet of sand, only shaded by innumerable bare trunks of trees. Here and there could be seen openings in these bare forests; these were the places where the plantations of coffee and sugar-cane had been located.

The whole country appeared exactly like a northern landscape in winter time and after a heavy fall of snow. Nothing green, nothing that would indicate the tropics, nothing that would show that the air was moist, that the temperature was high, that daily rains were thoroughly soaking the ground. The fall of the sand has been very different in different places. Along the base of the crater it had covered everything for miles around with a sheet of sand and mud about 60 feet thick. The nearest plantations were so completely hidden that it was not possible to locate the former houses. Ravines had been filled up and hollows had been levelled, while in other places immense hills had been formed by the erupted sand. In that vicinity only the larger trees could be seen above the sand sheet. Everything else was hidden below. As we proceeded farther away we found that the fall had been less, and at a distance of six miles from the crater the sand lies only from four to six feet deep, but the fall is not even. The deepest fall has been along a belt some five to six miles wide, extending from the crater hundreds of miles to the northwest, thus taking in the high upper slopes of the cordillera, but diminishing rapidly both towards the ocean and towards the interior. The extent of the fall of sand I have endeavoured to show in the map from my own observations and the reports of others. The farthest limit to which the erupted sand reached seems to have been about two hundred miles; while the lighter ashes reached as far as Acapulco and Merida, or about 550 miles.

A most striking feature of the country was the countless ditches


4 inches
TEHUANTEPEC
San Francisco Bar
Salina Cruz
Ventosa pt.
CHIPEQUE BAY
DON DIEGO
1 inch
TEHUANTEPEC
Tres Picos
6 inches
Tonala
2 inches



CAMPECHE
ZONES OF ASH DEPOSIT FROM VOLCANO SANTA MARIA
OCT-24TH 1902.
Tres Picos
1 inch.
6ft.
Tacana
Santa Maria
GUATEMALA
LAKE ATITLAN.
ATITLAN.
Lake
Amatitlan.
2 inches
Champerico.
2 inches
3 inches
S. Jose.
San Simon Bar.

or trenches, caused by the torrential rains rushing down from the hills. So furrowed was every part of the surface that we could hardly proceed six feet in any direction without having to pass a trench. The depth of the trenches varied according to location and the depth of the sand. On the slope of the crater cone some of these trenches were one hundred feet deep, not only the sand but also the original ground having been washed away. But at a distance of four or more miles we found no trenches deeper than six feet, while the majority varied from a few inches to several feet. To traverse such a ground was exceedingly laborious, it being a continuous jumping across the thousands of gullies and a continuous crawling up one bank and down another.

The effect of this washing out or early erosion can easily be imagined. Where formerly ran small brooks the bottom between the hills now formed irregular flats, upon which the water had spread as a thin sheet. But the greatest change had taken place in the largest rivers. The rivers Samalá, and Ocojíto had in places completely changed their course, cutting through and overflowing their banks, which had been partly, or even entirely, washed away. In most places the banks had been denuded of their trees for hundreds of yards inland, and the underlying boulders had been laid bare. The river-beds had been deepened some thirty feet, and widened in many places to twice their original size.

Almost every afternoon the rivers rose as much as thirty feet above their former high-water mark, carrying not water, as formerly, but a thick gruel-like mud, consisting of water, sand, ashes, and boulders. The aspect of these terrific torrents sweeping everything before them was something frightful. In the rushing waters were seen a mixture of trees, dead cattle, boulders, sand, broken limbs of trees, the whole roaring with the noise of distant thunder, and it was generally feared that the whole aspect of the river system would be changed, as, for instance, at the mouth of the River Ocos. The general opinion was that this mass of mud was thrown out of some opening in or below the new crater, and was not due to rains. But I am satisfied that this is not the case. Nearly all the barrancas in the upper part of the cordillera had been covered with from six to twenty feet of ashes and sand. If we remember that many of these barranca walls are almost perpendicular, and that daily torrential rains, lasting five or six hours, swept these accumulated masses of sand and ashes down in the former river-beds, we can easily understand that new outlets had to be formed. Much of the matter ejected from the crater consisted of pumice-stone, which,

on account of its lightness, remained on the surface of the flood-waters, and tended to block the narrow outlets of the gulches. To the mud, stones, and ashes, were added masses of broken limbs or trunks of trees, all at times closing the outlets in the barrancas, and backing up the flood-waters high above any former mark. Hundreds of such flood-lakes would then, perhaps, give away at the same time, and with renewed force be carried further down the rivers. As a consequence, all the smaller and most of the larger bridges were swept away during the third and fourth days of the eruption. They were later being replaced by wires strung over the torrents, and one could pass over suspended in a cage. Other bridges were being replaced by hammocks, over which the not too timid traveller could pass.

Nature of the Erupted Material.

The nature of this material differs somewhat with the locality. At a distance of five miles from the crater the lowest layer consists of white sand mixed with pieces of pumice-stone. This layer seems to occupy four-fifths or five-sixths of all the erupted mass. The upper one-fifth consists of bluish-gray sand of more uniform nature and of finer grains than the lower layers. In this darker deposit there is less pumice than in the lower layer. The upper part of the darker layer contains finer sand than the lower part, and has the appearance of well-mixed coarse mud. There is every reason to believe that the mud resulted from the mixing of sand and rain in the air and was not thrown out as mud from the volcano. It is evenly distributed, and the layer is sufficiently solid to support a mounted rider, the horse's hoofs leaving but little impression. The solidity of this upper layer is due to the fineness of its particles and their being packed by water. On the top of this darker layer fell several inches of light-coloured ash.

Within a radius of ten to twelve miles of the crater there fell also numerous stones. On the upper edge of the crater lies a belt of bluish finely-grained rock, about 800 feet in width. The blocks are large, weighing many tons each. Farther away from the crater the blocks are replaced by angular stones, from the size of a fist to that of a hazel nut. Some are finely grained, of a bluish colour; others contain large crystals of hornblende in a light-coloured matrix. The former resemble basalt; while the latter appear to be some kind of coarse granite. Compared with the enormous quantity of the erupted mass the stones are very few. Of pumice-stones both larger and smaller pieces were erupted. The larger pieces of

pumice are now most readily found caught in the branches of the trees. The largest found measured one foot in diameter; but these are exceptional, judging from the pumice found floating in the ocean. For miles and miles the surface is covered with a blanket of pumice-stone, entirely hiding the water from view.

The temperature of the projected sand seems to have been cold, at least when it reached the ground. The lowest vegetation immediately under the first deposited mass remains perfectly uninjured, and is yet fresh and green. In places where the rain has washed away the sand this vegetation, consisting of grass and tender leaves, is so little harmed that it begins growing when exposed to the light. It has not even been bleached. The sand could not, therefore, have been very hot when it reached the ground; but the fact that the stones thrown out appeared as shooting stars in the air sufficiently shows that the mass was intensely heated.

Besides these heavier particles of sand, stones, and ash there were enormous clouds of vapour ejected by the volcano, principally of steam mixed with sulphurous fumes. There was no eruption of fiery gases or directly poisonous fumes.

The later daily eruptions were confined to steam and gases, and at my departure from the volcano on December 4th no lava had been thrown out.

Loss and Injury caused by the Eruption.

Temporary Injury to Vegetation.—Within a district about twenty miles wide and seventy-five miles long all the trees lost their leaves and all the tender vegetation was injured. This destruction was due to the grinding effect of the falling sand and not to its temperature. In this vast district, which extended halfway down the coast to the ocean, not a green leaf could be seen when the clouds scattered sufficiently to allow a good view. Many of the trees had been split and killed by lightning; while nearly all had branches broken, and some were uprooted. The leaves of the Arabian coffee trees had dried up. The berries were dried, and had assumed a dark gray colour, long before they had arrived at maturity. These berries were still not entirely lost, but were being harvested as an inferior coffee. Where the fall of sand was less than two feet deep fewer leaves had been killed and more berries remained green. The Liberian coffee trees seemed to be uninjured, their berries and leaves remaining perfectly green, even in places where the native vegetation had been destroyed.

Where the fall of sand only amounted to five or six inches no

injury seems to have been caused. The actual loss of the coffee is calculated to have been about eight-tenths of the whole crop in the district devastated, or about one-half of the crop of the Pacific coast of Guatemala.

Permanent Injury to Vegetation.—This injury cannot as yet be accurately judged. Within a radius of three miles from the crater every particle of vegetation appears to have been permanently killed. I am of the opinion that where the coffee trees are covered with over four feet of sand the plants will be permanently destroyed; while, where less than this amount has fallen, it will take the surviving plants from two to three years to recover their bearing capacity. Where, however, the fall has been as little as five or six inches it seems as if the trees may recover in two seasons.

As to the permanent injury done to the forest trees, nothing can be now said, except that wherever they are covered up to any great extent they will probably die. The area of destroyed forest is less than the area within which the coffee plants are destroyed. Already, a month after the eruption, the majority of the trees began to send out fresh leaves from uninjured branches; while the coffee shrubs, which had lost their branches, sent out fresh leaves from their main trunks.

Injury to Animal Life.—Nearly all the birds over an enormous area seem to have been killed. After the first eruption birds could be seen everywhere on the roads in a dazed condition, running hither and thither, and easily caught by the hand. It is probably that all such starved and injured birds died. A month after the eruption the blackbirds had returned, and seemed as happy as before. They were probably the only birds which had sense enough to save themselves by flight. It is probable that mammalian life was destroyed to even a greater extent than the birds. At every step in the forest we were offended by the odour of dead animals buried under the sand. The world of insects seemed to be renewed. Butterflies and beetles were found in many places; while flies and mosquitoes were numerous. The large ants, called *zompopos*, had already began to dig their new canals, and we found them carrying up the underlying brown soil and placing it on the white sand five feet higher up.

Great numbers of cattle had been killed. Those that had not succumbed during the first few days had died afterwards from eating leaves and grass covered with sand or from drinking water mixed with mud.

Of human beings the loss was great, and it is probable that as many as 1,500 were killed, principally by falling roofs, or by lying down on the ground and thus being covered up. The majority of the men got drunk in order to "keep up their courage," I was told.* To this fact must be ascribed the greatest loss of life. Except in the immediate vicinity of the new crater nearly every human being could have saved himself by starting towards the coast at the first breaking out of the volcano.

INJURY TO THE SOIL.—In the vicinity of the crater the soil is covered by sixty feet of sand. All such land is irreparably destroyed. In places where the deposit only amounts to a few feet or a few inches the continued vegetation will soon form new top-layers of leaf mould. The newly-deposited sand is not likely to be able to produce surface crops until such mould is formed. This injury to the soil is more serious than any temporary injury done to the crops. Even in places where the coffee trees survive it is to be doubted if new shrubs can be made to grow in the new layers.

Another injury to the soil is found in the numerous gullies formed by the washing away of the sand. To cultivate such a soil will be very difficult and costly. Every inch of ground is covered with sand over a large territory. In a small village which had not been entirely destroyed some one calculated that there had fallen twenty thousand tons of sand for every man, woman, and child. And still in this place there were only nine inches of sand covering the ground.

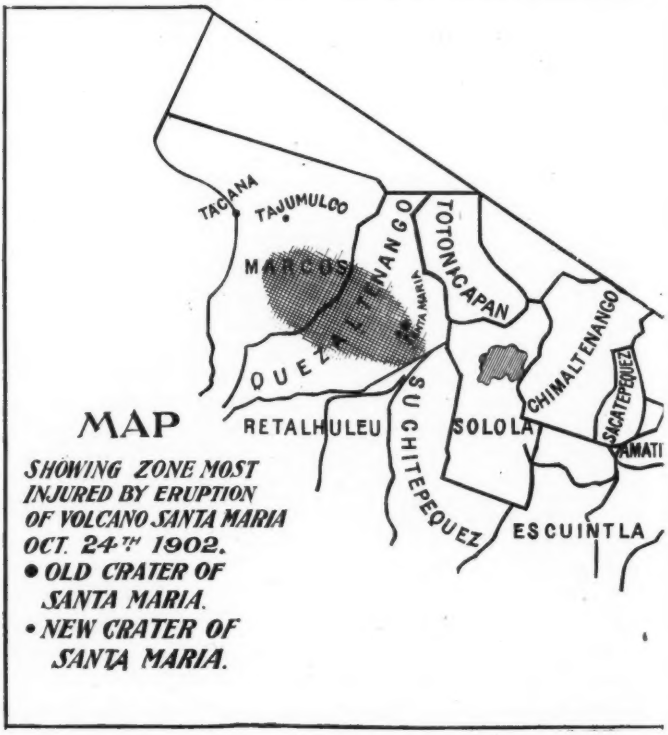
I was shown in several places ground which had been changed in colour by the deposited sand, and it was believed that such soil had been greatly injured in quality. Thus on the finca Felicidad the superintendent told me that his most fertile black soil had been turned red. We dug out such soil in various places; and though I had not examined it previously, I have every reason to credit the statement. But I had observed that the roads running through such black lands were always of a chocolate red, even in places where no sand had been deposited; and it seems probable that the change in the colour of the soil was due to some oxidation or other chemical action. The vegetation of this soil which had been changed to chocolate red was entirely uninjured by the overlying sand.

INJURY DONE TO BUILDINGS, ETC.—The injury done to buildings resulted principally from the caving-in of the roofs through the

*A statement more easily made than verified.—(*Ed. Bulletin.*)

accumulation of sand. It has been great, but it has been much overestimated. In Retalhuleu, for instance, the first reports were that almost every house had been destroyed, while in fact not a single house had caved in or been seriously injured.

Injury to the Land in General.—Great injury has been done to the river-beds and river banks, as has already been stated. This injury is permanent; but it is lessened by the fact that the beds have



now been made larger, and future floods will be less destructive. One of the most serious results of the eruption is that for several leagues on each side of the port of Ocos the shore-line has subsided. About one hundred feet all along this coast has sunk down, and the waves now reach up to the very houses which before the eruption stood that distance away from the shore. This subsidence began after the earthquake of April 18th, but increased after the eruption. The costly iron pier for the landing of freight was

broken in two by the earthquake, and the injury done then has since increased. The lower part of the River Ocos changed its course, and the village is now threatened also from that side.

Comparative Injury of the Various Zones in the Devastated District.—The part of the coast especially injured by the eruption is generally known to outsiders as the Costa Cuca. The inhabitants, however, divide this coast into several distinct zones, separated by rivers or places not well suited to the cultivation of coffèe. These zones have been variously affected by the eruption, as follows:

Xolhuitz.—About six leagues square. The largest part of the coffee and sugar-cane crop is destroyed.

Costa Cuca.—About 12 leagues by 6 leagues. Totally destroyed crops.

Chuva.—About 8 leagues by 4. Crops almost totally destroyed.

Costa Grande.—About 8 leagues by 3. Crops partly ruined.

Tumbador.—About 8 leagues by 3. Only slightly injured.

Costa Pamachan.—About 6 leagues by 8. Crops not injured.

Red Sunsets.

Before the eruption of Santa Maria no such red sunsets had been seen anywhere. But immediately after the eruption red or blood red evening skies were observed in the belt covered with ashes. These sunsets did not reach Guatemala City for one month after the eruption, the winds probably carrying the ashes the other way. When I passed along the Pacific coast in the middle of December the red sunsets did not appear higher up than Acapulco. Several weeks later they had reached the coast of California, but were of much less intensity than in Guatemala. They seemed to decrease in intensity as they proceeded northwards.

Prehistoric Eruptions of Sand and Ash.

It is of considerable interest to inquire into the effects caused by former eruptions of the Guatemala volcanoes, and if, perchance, any one of them resembled the eruption of Santa Maria. I made a special point to study this matter wherever opportunity offered.

As already noted, the eruptions of the Guatemala volcanoes since the earliest times have been of three kinds. The first eruptions were those of basaltic rocks. These lava-flows are yet, to a great extent, in evidence, their topsoil, as well as their alluvial deposits surrounding them, having been washed away long before the present alluvium of the coast was formed.

The second, andesite volcanoes, seem never to have produced any lava-flow of extraordinary dimensions. At least in modern times all lava-flows have been small and ceased not very far from the craters. The third class of eruptions consisted of sand and ash of nearly the same quality as those of the last eruption. From below Pacaya to the northern end of Tacaná the slope of the coast is mainly made up of deposits of white sand, covered by layers of various coloured humus soils, varying in depth from a few feet to a hundred feet. On the coast side there is little opportunity to study these deposits, but to the interior of the cordillera the numerous and deep barrancas offer excellent profiles for study. All the volcanoes, with the possible exception of Pacaya, have in prehistoric times thrown out immense quantities of ash and sand, principally made up of finely-ground pumice-stone. These deposits reach as far northwards as Salamá, Rabinal, Huehuetenango, etc., and seem to have been carried there from the Pacific coast volcanoes yet in existence. The greatest deposits, both as regards extent and thickness, are those found north of the Volcan de Agua. On the way from Chimaltenango to Mexico we pass several deep barrancas in which the strata of volcanic sand and ash alternate with strata of chocolate-coloured loams. I have counted eight or nine such alternating layers. Generally, the layer of chocolate loam is from one to six feet deep; while the white sand and ash layers are from ten to twenty-five feet deep. But in a barranca near Santiago, Sacatepequez one of these layers of erupted sand measured about one hundred and fifty feet, and immediately below it was seen a stratum of chocolate-coloured soil about six feet thick. It will thus be seen that at certain intervals eruptions of sand and ash have taken place since the first volcanic outbreaks, and that these eruptions have been succeeded by periods during which vegetation regained its hold and was able to form a humus of a chocolate colour from one foot to ten feet in thickness. The most recent of these, the largest deposits of sand, seems to have come from Agua. The uppermost erupted layer from this volcano, as observed on the road from Antigua to Guatemala City, averages in depth about four feet. Above this layer is deposited a stratum of humus about three feet thick. If we could calculate the time it takes in this region to form a certain layer of soil it would, of course, be possible to determine the years gone by since the last eruption of Agua. This may have occurred three or four thousand years ago, the formation of humus in this region being very slow, on account of the long dry season and the poor vegetation generally so far inland.

THE CLIMATE OF SOUTH AMERICA.*

BY

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The chief controls of the climate of South America are (1) the triangular shape of the continent, which is broadest near the equator and narrows southward; (2) the lofty mountain ranges along the western border, and (3) the cold ocean current off the Pacific coast. The broadening of the land-mass near the equator and the absence of high mountains along the Atlantic coast expose the greater portion of the vast northern and northeastern sections of the continent to the influence of the northeast and southeast trades, and ensure a remarkable uniformity of climate, with very small temperature ranges, over this whole region. The narrowing of the land-mass towards the south prevents the strong seasonal variations in temperature which characterize the broader continental areas in corresponding latitudes of the northern hemisphere, as, for example, in the case of North America. North America, like South America, is open on the east to the influence of the Atlantic; but while this fact is of the greatest importance in the southern continent, where the trades are thus given free access into the interior, the absence of high mountains along our own Atlantic coast has much less effect, because our prevailing winds are offshore. The mountains along the west coast of South America provoke rainfall on their windward slopes, and form a clearly-defined barrier between the climates of the narrow Pacific coastal

* The writer is indebted to the editors of "The Times" Supplement to the *Encyclopædia Britannica* for permission to make use here of his article on The Climate of South America, which was written for that Encyclopædia.

Reference may be made to the following articles by the writer, in which various additional facts in connection with the climate of South America are emphasized: "Meteorology in South America," *Science*, N. S., Vol. V, 1897, 523–525; "Water Surface Temperatures of Lake Titicaca," *ibid.*, Vol. VII, 1898, 28–29; "Climatic Contrasts along the Oroya Railway," *ibid.*, 133–136; "A Note on the South American Coastal Cloud," *ibid.*, 1898, 211–212; "A Winter Barograph Curve from the South Pacific Ocean," *Monthly Weather Review*, Vol. XXV, 1897, 484–485; "The Climatic Control of Occupation in Chile," *Journal of School Geography*, Vol. II, 1897, 289–292; "Climatic Notes made during a Voyage around South America," *ibid.*, 1898, 241–248, 297–311; "A Day in the Falkland Islands," *Journal of School Geography*, Vol. II, 1898, 49–56.

zone and those of the eastern slopes and plains. The cold Peruvian current is instrumental in giving the coast of northern Chile and Peru temperatures considerably below those which are common to their latitudes, and in contributing largely to the aridity of these countries.

South America lies between the mean annual isotherms of 40° and 80° Fahr. The northern and northeastern portions of the continent, down nearly to the latitude of Rio de Janeiro, are within the district enclosed by the mean annual isotherm of 80°. The cold Peruvian current deflects the isotherms strongly equatorward along the Pacific coast, especially between latitudes 30° south and the equator; while these same isotherms loop strongly poleward over the land. These deflections are much less marked towards the southern extremity of the continent. The equatorward deflection of the isotherms on the west coast results in giving places on that coast much lower temperatures than those of stations in corresponding, or even in much higher, latitudes on the east coast. Thus Lima, in latitude 12° south, has a mean annual temperature of 66.2°; while Rio de Janeiro, which is nearly on the tropic on the east coast, has a mean annual of 72.1°. Pernambuco, in latitude 8° south, also on the east coast, has a mean annual temperature of 78.4°. The mean annual temperatures on the Atlantic coast between latitudes 30° and 40° south are about 5° higher than those in corresponding latitudes on the Pacific coast.

The seasonal migration of the sun north and south of the equator involves some changes in the distribution of temperature over South America. The average position of the axis of the equatorial belt of high temperature ("mean annual heat equator") is on the immediate sea coast in northeastern Brazil. From here the line runs northwest, parallel with the coast of Guiana and Venezuela. In January the heat equator moves to about latitude 15° south, in Brazil; while in July it migrates northward beyond the limits of the continent. In the former month the isotherm of 50° crosses the southernmost extremity of South America; while the belt of highest temperatures, enclosed by the isotherm of 80°, covers eastern and southern Brazil, and extends well into Argentina. In the southern winter (July) the temperature gradient over South America is somewhat stronger than in summer (January); but the change in the value of this gradient is not nearly so considerable as it is over the northern continents. Thus it appears that the southern summer is not marked by excessively high mean temperatures, and the southern winter is moderate, even in the higher latitudes. In

July the isotherm of 30° is found somewhat south of Cape Horn; while the belt of highest temperatures (over 80°) is found along the northern and northeastern coasts.

The mean annual ranges of temperature are very small over all of South America. Over the northern portion of the continent, including Peru, northern Bolivia, and the greater portion of Brazil, the range is less than 10°. Over a considerable part of this same area the range is even less than 5°. South of the tropic and east of the Andes the ranges increase to between 30° and 40° in northern Argentina. In contrast with these larger ranges in the continental interior on the eastern side of the Andes, the mean annual ranges in Chile, on the other hand, are less than 20°. The whole of the narrow western coastal strip thus has a very moderate climate. Even in the higher latitudes the winters are very mild, and the summers distinctly cool. One of the most notable facts in connection with the temperatures of South America is the marked negative anomaly (−10°) near the equator off the west coast, which is due to the cold ocean water from the Antarctic flowing along the coast as the Peruvian or Humboldt Current. The effect of this cold water upon the temperature of the continent is seen in the presence of a negative anomaly of more than 2° along the coasts of Chile and Peru.

Another interesting effect is the exclusion of coral polyps from the Galapagos Islands; while they live on similar islands in much higher latitudes farther west in the Pacific.

Over a portion of the coasts of Guiana and of eastern Venezuela the mean minimum temperatures average over 68°. The lowest mean minima are found in the interior, east of the Andes and south of latitude 20° south. Temperatures below 32° occur normally every winter over the highlands of the southern interior of Brazil, and thence southward over the interior of Argentina. The highest mean maxima (104°) occur in the northern portion of Argentina. All of the west coast has decidedly lower maxima. Throughout the mountainous region of South America, altitude controls temperature to a marked degree. Places situated far above sea-level —as, for example, Quito—enjoy "perpetual spring" temperature. On the high peaks, even on the equator, there is eternal snow. An interesting lesson in the effect of elevation above sea-level in modifying climate may be learned by any one who takes a trip up the famous Oroya Railway, from sea-level at Callao to a height of 12,178 feet at Oroya, passing on the way, at Galera Tunnel, a height of 15,665 feet—the highest point reached by any railroad in

the world. The first part of the journey is through fields of sugar-cane and cotton; at 5,000 feet a zone of fruit trees is passed through; at 10,500 feet there is a district famous for its potatoes, where little else is grown; above this the altitude is so great as to preclude the growth of anything but grass. At the highest point reached the snow lies on the mountain summits throughout the year, and the traveller may enjoy a snowstorm in the middle of summer (December–February). Farther along the railroad, in the valley of Oroya, farm produce is again seen growing. This whole succession of climates may be passed through in the short space of ten hours—an opportunity offered to the traveller nowhere else in the world.

For the mean of the year, the barometric equator (axis of the equatorial belt of low pressure) crosses South America closely along the line of the geographic equator, running north of it on the west coast. The central portion of the continent is under the control of the tropical high-pressure belt; while over the southern extremity the pressure decreases rapidly towards the South Polar region. The seasonal migration of sun and heat equator involves a sympathetic migration of barometric equator and tropical high-pressure ("horse latitude") belt. In January the barometric equator moves south to about latitude 15° south in Brazil; while the axis of the tropical high-pressure belt, which is interrupted over the continent, lies about along latitude 30° south in the Atlantic and latitude 35° south in the Pacific. In July the barometric equator lies along the northern coast, and the axis of the tropical high-pressure belt is also farther north than in January. Seasonal changes and mean monthly ranges of pressure are slight.

The prevailing winds are controlled by the pressure distribution just noted. The broad northern portion of the continent east of the Andes and north of the tropical high-pressure belt is in the trade-wind zone. Here the trades prevail, as a rule, throughout the year, except when the sun is overhead. They are then temporarily replaced by the equatorial belt of calms and rains, which migrates north and south over the northern portion of the continent, following the sun. The west coast within the trade-wind latitudes south of the equator has its own system of winds, which is under the control of the tropical high-pressure area of the Pacific. These winds blow from a southerly direction along the coast nearly to the equator. Coming from a high latitude, and blowing over a cold current, these are cool and drying winds. The winds of extra-tropical South America are also chiefly controlled by the tropical

high-pressure areas of the South Atlantic and South Pacific oceans. The former of these areas gives easterly and southeasterly winds over the lower latitudes of the eastern portion of the continent, and prevailing northwesterly winds in the higher latitudes. On the west coast strong southerly winds blow with trade-like regularity along the coast north of the Pacific anticyclone; while northwesterly winds prevail to the south of it. The seasonal migration of these areas of high pressure involves a corresponding shift in the wind systems under their control. In summer, when the high-pressure belt is farthest south, south and southwest winds prevail along the west coast between 30° and 40° south; while south of latitude 40° north and northwest winds predominate. In winter the winds between 30° and 40° south are variable, with some calms; while the west and northwest winds blow nearer the equator than in summer. Thus the latitudes occupied by the southerly winds are extended in summer, and those occupied by the northerly and northwesterly winds are extended in winter. The harbour of Valparaiso, although well enclosed towards the south, is open to the north. When a *norte*, the indraught from lower latitudes towards a cyclonic centre, blows, as it often does in winter, and with considerable violence, the vessels at anchor in the bay are obliged to steam or to be towed out into the open ocean in order to avoid being blown ashore. In corresponding latitudes on the east coast there is also a northward extension of the limits of the northwest winds in winter. In Argentina northeast, east, and southeast winds increase in summer, and north, northwest, and west winds in winter. South of the tropic, and directly in the lee of the Andes, winds are of light velocity, and calms are frequent; while farther east, at a greater distance from the mountains, the velocity increases, and strong winds are common. In the mountains the winds are much influenced by local topography.

Darwin first distinctly emphasized the essential features of South American rainfall. In the latitudes of prevailing westerly winds (trades) the eastern side of the continent and the eastern slopes of the Andes are well watered; while the western slopes are comparatively dry. In the latitudes of prevailing westerly winds the western slopes of the mountains have the most precipitation; while the eastern side is dry. The rainfall is considerable (60–80 inches and over) on the elevated windward coasts of the continent (Guiana, southeastern Brazil) within the trade-wind belts, as it is on the eastern slopes of the Andes and over an extended area along the River Amazon. Within the southeast trade belt there is notably

less rainfall in the lee of the highlands of southeastern Brazil, and the rainfall also decreases rapidly in the interior over the more southern latitudes of this same belt, the country becoming almost a desert towards the eastern base of the Andes. The migration of the belt of equatorial calms and rains over the northern portion of South America involves a seasonal rainfall over the greater portion of the trade-wind latitudes. There is a dry season while the trade blows, and a rainy season while the equatorial rainy belt is overhead. This seasonal rainfall is well shown in the rainfall over the *llanos* of Venezuela and the *campos* of Brazil. The llanos have their rains during the northern summer, when they are under the equatorial rainy belt. During the rest of the year they are dry, when the sun is south and the trades blow across them. The *campos* of Brazil likewise have their rain in their summer (October–April), when the sun is south of the equator; while dry weather prevails during their winter, when the trades blow. The coasts of Guiana and Pernambuco and Bahia have winter rains. These rains are heavy, and are due to the onshore winds and the presence of high land near the coast. Pernambuco, situated just south of the extreme eastern point of South America, is exposed during most of the year to the strong southeast swell, produced by the southeast trade, and landing is therefore often very difficult.

The west coast within the trade-wind latitudes, from about 4° to about 30° south, is very dry. It is shut off from the trades by the great Cordilleran ranges on the east, and has prevailing cool southerly winds. These southerly winds, the spiral outflow on the eastern side of the South Pacific barometric maximum, cooled by the cool ocean water over which they blow, are decidedly warmed when they flow over the warmer land, and thus become drying winds, their capacity for water vapour being increased as their temperature is raised, although the presence of a range of coast-hills near the sea, along the greater part of the west coast, obliges these southerly winds to climb, and the adiabatic cooling produced by their ascent is not carried far enough, under ordinary circumstances, to produce rain. The coast cloud is a very marked phenomenon more or less all along the coast north of Valparaiso. It extends inland ten or fifteen miles at the points where the writer was able to make personal observations on it, and its base is between 2,000 and 3,000 feet above sea-level. As long as the southerly winds and the cool ocean current follow the coast, so long is the coastal strip dry and barren. As soon as the winds and current turn offshore, the previously-barren shores become covered with

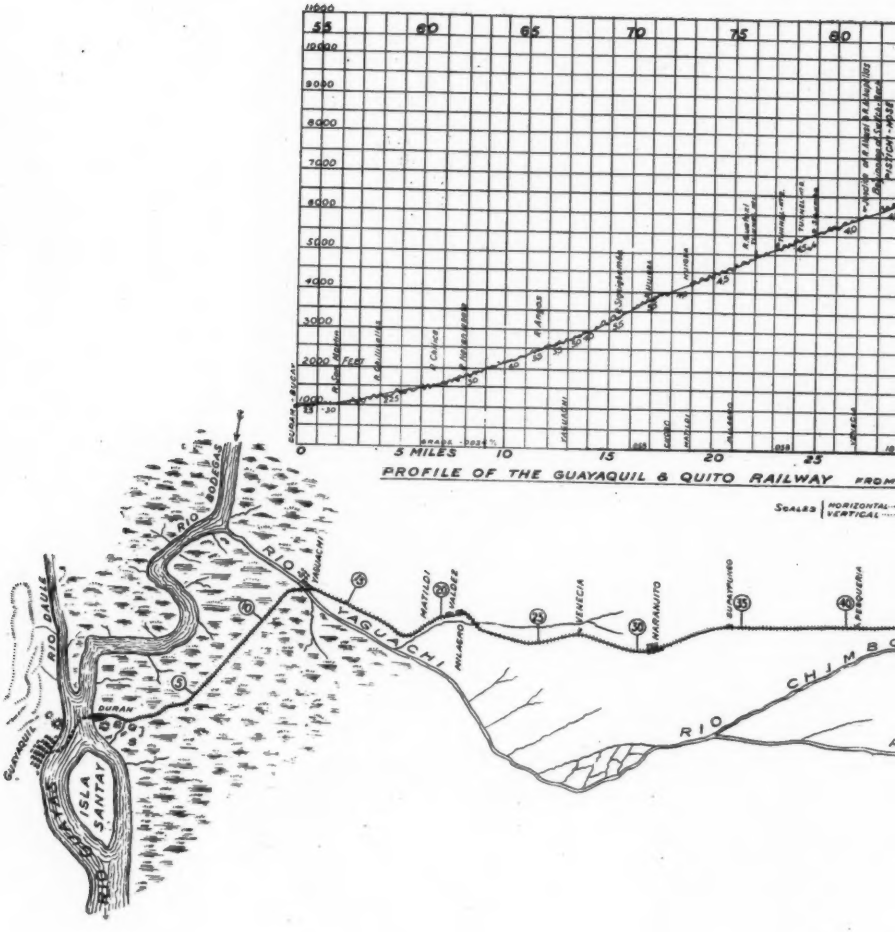
vegetation. Analogous examples are to be found on the west coast of North America and the west coast of Africa. Although it very seldom rains along the desert coastal strip, rain and snow fall on the mountains of Peru and Bolivia during the summer. North of latitude 3° or 4° south there is abundant rainfall from the equatorial rainy belt, reaching 160 inches a year on the coast of Colombia north of the equator. Guayaquil has its rainy season from December to May. Near the west coast the migration of the equatorial rain-belt produces two rainy seasons when the sun is overhead, and two dry seasons when the sun is north and south. Quito and Bogotá have this double maximum of rainfall. Within the latitudes of the prevailing westerly winds the rainfall reaches over 80 inches annually along the southern coast of Chile. East of the Andes, over much of the pampas of Argentina and Patagonia, the average is under 10 inches. Towards the southern extremity of the continent the rainfall east of the mountains increases again, reaching 40 inches a year in the extreme southeast. In southern Patagonia the barrier on the west, owing to the diminishing heights of the mountains towards the south, is less effective than farther north. Furthermore, there is also a considerable precipitation from winter cyclones, whose influence extends over the low-lying Patagonian coast from the neighbouring Atlantic.

There is a seasonal distribution of rainfall in Chile, which depends upon the migration of the tropical high-pressure belt. Northern Chile, north of about latitude 30°, is always dry. Here is the desert of Atacama. Southern Chile has rain throughout the year, because it is always under the régime of the prevailing westerly winds. In the central portion there are rains only in winter, when the westerlies blow on that coast. The great climatic interest of the west coast of South America lies in the contrasts between the heavy rainfall on the southern coast of Chile, the intermediate barren desert belt of northern Chile and Peru, and the heavy rainfall on the coast north of Cape Blanco and Pt. Pariña, the westernmost point of the continent. These differences in rainfall have a close analogy in the rainfall on the west coast of North America.

So far as observation goes, no tropical cyclones originate in the South Atlantic, and all of equatorial South America is free from them. Cyclonic storms are, however, very common in the latitudes occupied by the prevailing westerly winds. The passage of such cyclonic storms across Argentina causes marked changes in wind, temperature, and weather. The warm, damp northerly wind (*norte*) in front of these depressions is followed by the cool, dry *pampero*

from the southwest, on the rear. The *pampero* corresponds in general to our own northwest wind, which is the rear indraft into a cyclonic centre. It is usually cool, dry, and bracing. The exclamation attributed to the first Spanish arrivals in this region, "*Que buenos aires son estos!*" must have referred to the conditions which prevail with a southerly wind, and not to those which the *norte* brings. The name *Buenos Aires* perpetuates, as is often the case with geographical names, a climatic feature of the region in which the city lies. Thunderstorms are most frequent over the northwest coast, as far as latitude 4° south, and occur in considerable numbers over all of South America within the tropics, except on the west coast, south of latitude 4°. The violent summer thunderstorms of the Argentine and of Uruguay often do serious damage to shipping in the Rio de la Plata estuary. The strength and the steadiness of the cyclonic-bearing westerly winds around the southern extremity of South America usually make the voyage around Cape Horn from the east very stormy and tedious; whereas vessels passing the Horn from the west usually have fair winds. The Strait of Magellan is used by all steamers which have to go around the southern end of South America; while sailing vessels are obliged to round the Horn, owing to the narrowness of the Strait and the difficulties of navigation through it.

Following Supan, South America may be divided into six climatic provinces. The first ("Tropical Cordilleran") includes the extreme northwestern section (the coasts of Colombia and Ecuador), with "perpetual spring" climates at high altitudes; high temperature near sea-level, and tropical rains. The second ("South American Tropical") takes in the vast northern and northeastern territory east of the Andes, and reaches somewhat south of the tropic. This is under the control of trades and of equatorial rains, and has mean annual temperatures over 80°. The third ("Peruvian") extends along the Pacific coast to 30° south, including northern Chile. This province is abnormally cool and rainless. The "North Chilian" province adjoining it on the south has a sub-tropical climate, with winter rains. Further south, the "South Chilian" province takes in the extreme southern extremity of the continent, is very rainy, and has equable temperatures throughout the year, with cool summers. The sixth ("Pampa") province, which includes the section east of the Andes and south of the "Tropical" province, has a fairly large range of temperature, especially in the north; while rain is not plentiful.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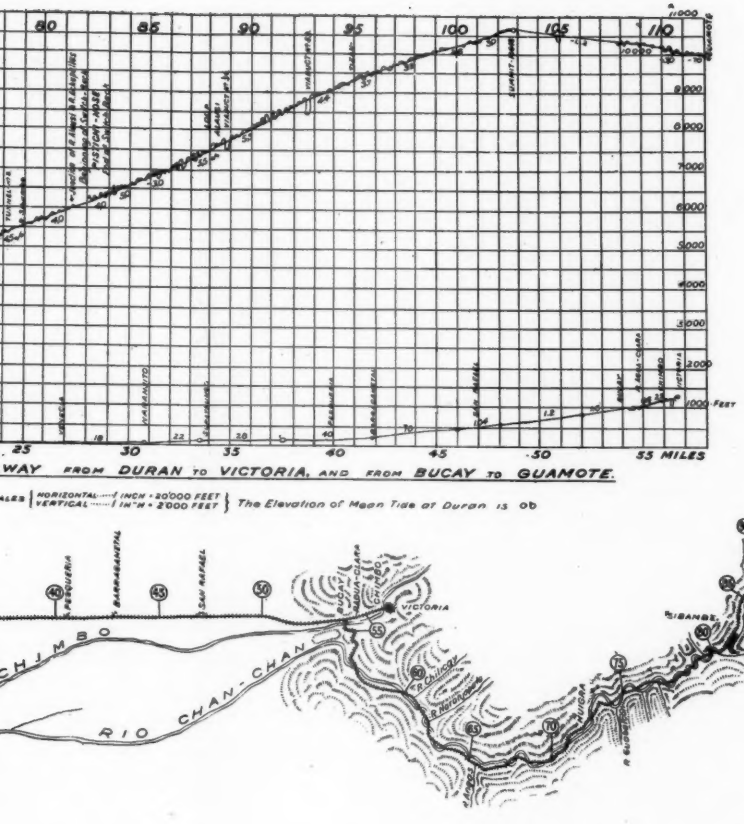
PROFILE OF THE GUAYAQUIL & QUITO RAILWAY
SCALES
HORIZONTAL
VERTICAL
RIO BABAHOYO
RIO DAULE
RIO VINCES
RIO YAGUACHI
GUAYAQUIL
DURAN
ISLA SANTAY
RIO BUIJAS
MATILDE
VALDEZ
VENECIA
NARANJITO
GUAYPUNGO
PEDREGAL
CHIMBO
RIO



MAP OF THE GUAYAQUIL & QUITO RAILWAY
FROM DURAN TO GUAMOTE
VICTORIA JUNE 1902
SCALE 1 INCH = 20000 FT
0 1 2 3 4 5 6 7 8 9 10 MILES

GUAYAQUIL AND QUITO RAILWAY.

BY

F. W. BENNETT.

Among South American countries Ecuador has been especially backward in railway construction. The country, from north to south, is traversed by two cordilleras of the Andes, on which are found some of the loftiest summits of the American continent. Between these ranges, at an elevation of from 8,000 to 12,000 feet, is a plateau, in the plains and valleys of which the bulk of the population live. Their only communication, across the mountains to the coast, has been by pack trains, over trails for many months of the year scarcely passable. Here, apart from the current of modern progress, they have lived in practically the same condition since Pizarro conquered the ancient kingdom of Quito.

Recently, there has been finished a railway to the heart of this beautiful region, connecting it with the principal seaport, Guayaquil. As early as 1873 the first link of this railway was built by the Government. Beginning at Yaguachi, thirty miles of road were built, in an easterly direction, through the towns of Milagro and Naranjito. Connection between Guayaquil and Yaguachi was made by small river steamers. The assassination of the President, Garcia Moreno, worthy of remembrance for his great abilities, stopped further progress for twelve years.

In 1885 the Government entered into a contract to extend the road to Guayaquil and to Riobamba, in the interior. The Yaguachi River was bridged, and the road built to a point called Duran, on the Guayas River. Guayaquil is three miles below, on the opposite side of the river, and a ferry is run between the two places. This part of the line was built across a swamp, and for a number of years, till sufficient ballast had been hauled, much trouble was caused by the settling of the roadbed. It was also flooded every rainy season; but the opening of numerous wide culverts has remedied this defect.

The largest steamers engaged in the west coast trade visit Guayaquil; and there is sufficient depth of water for them to ascend to Duran and discharge cargoes at wharves, which could be constructed without large expense, as deep water extends close inshore.

To the eastward, over the coast plain, the road was extended to

Chimbo, at the foot of the mountains. From Yaguachi to Chimbo, 56 miles from Duran, the surface is a plain, rising almost imperceptibly to an elevation of 1,000 feet at Chimbo. This plain is heavily timbered, save where, in the vicinity of the line, plantations of sugar, coffee, rubber and cacao have been cleared.

At Chimbo the real difficulties of the enterprise, the ascent of the mountain, commenced. A continuous grade of 3% and curves as small as 40° were used. Numerous switchbacks were proposed to make the necessary development. Difficulties, both physical and financial, soon led to the abandonment of the work, and it was thirteen years more before anything further was accomplished.

In 1898 the Government of General Alfaro let a contract to a company of English and American capitalists to extend the road to Quito. It is due to this company that by far the most difficult and costly part of the line has already been built.

Realizing the disadvantages of the line previously projected, a survey was made up the Chimbo River, crossing the cordillera at the foot of Chimborazo; but it was found that this route offered no advantages over the other. There remained only, with the limitations of grade imposed by the contract, the region of the former attempt.

The Chan-Chan River breaks through the western cordillera in a deep gorge near Chimbo. High up on its precipitous slopes the line was located and construction started. This part of the Andes is of the cretaceous formation. The slopes, facing the Pacific, are bathed in perpetual mist and rain. The action of the waters, the chemical action accelerated by the tropical climate, has disintegrated the original soft rock; land-slides have been of frequent occurrence, till the slopes to great depths consist almost entirely of a compacted earthy material, resting just at the angle of repose, but held somewhat by a mass of tropical vegetation. When the right of way was cleared, and deep cuts were made, after the season of the heavier rains commenced, the whole mountain above, in many instances, began to move. The line had to be abandoned.

Undaunted by failure, the company turned its attention to a valley line in the bottom of the gorge of the Chan-Chan. But this was only possible by using an increased gradient. A new contract was made with the Government, by which grades up to 5½% were permitted. By using the narrow bottom lands, crossing and recrossing the stream to avoid cliffs and heavy cuttings, a practicable line was secured.

Beginning at a point called Bucay, on the old line, 54 miles from

Duran, the River Chimbo is crossed by a two-span steel bridge 177 feet in length. The line then passes over the low dividing ridge, between the Chimbo and Chan-Chan rivers, and enters the valley of the latter stream, which it follows to the eightieth mile. The river is crossed no less than twenty-six times. There are in all forty-three steel bridges on this part of the line. I-beams are used for spans up to 30 feet; from 30 feet to 100 feet plate girders, and from 100 feet to 153 feet, the longest span, either riveted or pin-connected trusses. The abutments are either of concrete or stone masonry, and are of the best construction. Three projecting points were cut off with tunnels, one of which, 256 feet in length, was lined with timber.

At the eightieth mile the Chan-Chan is formed by the junction of the Alausi and Achupallas rivers. The Alausi, in the lower part of its course, has a fall of 12% or over in many places; while above its fall is from 3% to 5½%, thus reversing the fall usual in most rivers. To ascend to the upper course of the river development became necessary. For ten miles the line is supported on the mountain side. Development was accomplished by a switchback and a loop. Cuts here are not so difficult to maintain, as the country is much drier, and the material of a different character from that below.

The switchback lies on the steep slopes of a bold nose of rock jutting out where the two rivers meet. Numerous retaining-walls were necessary. In one place a trestle 200 feet long is built on the slope. At the eighty-eighth mile, near the village of Alausi, the line crosses a ravine on a steel viaduct 340 feet long. Two other ravines above are crossed by single-span bridges. At the ninety-second mile the line crosses the Alausi, below a fall, on a steel viaduct 373 feet long and 122 feet high, and then re-enters the river bottom, which is followed for 8 miles more. The line then ascends a small side stream to the broad flat pass of Tiocajas, the divide between the waters of the Pacific and the Amazon, at an elevation of 10,648 feet. Then, descending over an easy country, the village of Guamote, 112 miles from Duran, is reached. The road is in operation to this point at present.

The gauge of the road is 3 feet 6 inches, and the weight of rail 55 lb. per yard. Ties are of California redwood. All timber, except for the most temporary purposes, had to be brought from California or Oregon. There is no timber in the interior, except the planted eucalyptus. Firewood, for domestic purposes, is brought for miles from the scrubby growth on the high mountain side. Both

wood from the coast and English or Australian coal are used in the locomotives. Near Guamote a promising bed of coal has been discovered, which, it is hoped, will solve the fuel question. The Shea geared engine is used mostly on the mountain division.

The minimum curve is 29°, and the maximum grade 5½% compensated. This maximum grade is confined to a portion of the mountain division 38 miles long. The remainder of the constructed line, and the line yet to be built, will have a grade not to exceed 3% on tangents. The heavy grade is to be operated as a pusher. With the fine water-power easily developed close at hand, sooner or later this part of the line, at least, will be operated by electric power.

Construction, especially in the Chan-Chan valley, was attended by many difficulties. No one had passed up the gorge previous to the location of the railway. The first thing to be done was the building of a mule trail. All heavy construction material could only be brought ahead as the track was laid, though tools, explosives, food, and a great deal of cement were packed over the rough trails. On the lower section of the line timber was dragged by oxen down the mountain side for the construction of temporary bridges.

The native Indian labourers, who live by choice in the highest altitudes, sicken at once when brought to work in the lowlands. The Chan-Chan valley, especially, had a bad name with them for its unhealthfulness. Until an elevation of 6,000 feet was reached none of them could be induced to work. The labour for the construction of the lower part of the line had to be imported from Jamaica.

From Guamote to Quito, 160 miles, the road will lie over a much easier country. The route passes over a rich agricultural region, through numerous towns, and the cities of Riobamba, Ambato, and Latacunga. On either hand lie the snow-clad summits of Chimborazo, Tunguragua, Iliniza, and Cotopaxi. This part of the line would form a link of the proposed Intercontinental Railway. At present the journey is made by stage coaches over the highway built by Garcia Moreno. This road is 30 feet wide, and in places is paved for miles; grades do not exceed 12%, and the streams are spanned by beautiful stone arch bridges.

The advent of the railway seems to have quickened interest in the almost unknown territory of the Oriente, lying at the foot of the eastern cordillera. The Government is now building three roads into this country. All accounts describe it as having a fine climate and as rich in all natural resources.

NOTES ON THE U. S. GEOLOGICAL SURVEY.

The United States Geological Survey has recently changed, somewhat, its plan of publication. For several years the Director's Report, with accompanying papers and a review of mineral resources, has filled several large volumes annually. Hereafter the Director's Report will be confined to one volume, and a series of unbound Professional Papers of quarto size will be issued. The Mineral Resources will appear separately in ordinary octavo, as also the series of Bulletins designed to place promptly before the public matters of economic and scientific interest. There is continued, also, the series of Water-Supply and Irrigation Papers. All of the above are open to free distribution by the Survey and by Members of Congress. The folios, atlases, and monographs will, as usual, be sold at the cost of publication. Circulars and maps giving lists of publications, and showing the progress of the topographic survey, may be had on application to the Director of the Survey.

Of the Water-Supply and Irrigation Papers, Nos. 65 to 79 have recently been received. This series does not contain all of the material on these subjects that is issued by the Survey. Extended reports on hydrography and on various aspects of irrigation have made part of the annual reports for several years.

No. 76 of the series named above is by Mr. H. A. Pressey, and gives a review of observations on the flow of rivers in the vicinity of New York City (108 pp., 1903). From 1890 to 1900 the use of water-power in the United States increased 30 per cent., or nearly one-half million horse-power. This fact alone shows the value of quantitative study of our streams. The case of Austin, Texas, is cited by the author. A power plant was there built at a cost of $1,600,000, and it was then found that the flow of water fell 500 per cent. below the estimate. In one instance in New York State five engineers gave in their results, making the minimum flow vary as one to two.

Possible water supply for New York City is noted in the light of ascertained conclusions—namely, that Lake George is inadequate, that Lake Champlain is too low for economical use, and that the Great Lakes would be tapped at too great expense. Several stations for gauging were established in 1901, and furnished the data for this paper. The stations and streams were as follows

(all in New York except one): Dover Plains, on Tenmile River; Gaylordsville, Conn., on the Housatonic; South Cairo, on Catskill Creek; Kingston, on Esopus Creek; New Paltz, on Wallkill River; Rosendale, on Rondout Creek, and Glenham, on Fishkill Creek.

Observations on the height of the water were made twice each day and current-meter measurements at frequent intervals. These observations supply data for computing the annual flow, and with accompanying maps for determining sites of needed reservoirs. Methods of finding velocity are described, including the use of current-meters, surface and sub-surface floats, and weirs or dams. The last, already in existence for other purposes, often supply a convenient means of computing the discharge. Both the methods and the results may be considered as typical of the work performed by the Survey in all parts of the United States and serving the needs of those who use power or seek for water supply.

The report also gives studies of turbidity and colour, the latter being mainly due to vegetable matter in solution. The waters of New England and New York are little turbid as compared with those of the South Atlantic States or those of the Ohio and Mississippi Rivers. The turbidity determines the amount of coagulant needed in filters and the size of reservoirs needed to supply clear waters in periods when the rivers are carrying a large body of land waste. Detailed tables show turbidity, colour, alkalinity, hardness, and discharge per second for the several streams.

Paper No. 79 in the same series is by M. O. Leighton, and bears the title Normal and Polluted Waters in Northeastern United States. Rivers vary in the purposes for which they are of most value. Some streams are worth more for carrying away the refuse of manufacture than they could be for harvesting ice or for fishing grounds. The Merrimac, which is first studied, has small value for transportation, is famous for power, and has important ice fields about its upper waters. This river, as a whole, has been studied more carefully, in the author's opinion, than any other river in the world. Pollution of the lower river has been serious, and has taught costly lessons, particularly in Lowell and Lawrence. There, as commonly, the loss entailed was far beyond the cost of prevention. An interesting contrast appears between two tributaries—namely, the Sudbury and the Assabet, forming the Concord. Both basins are thickly populated; but the waters of the former are nearly normal, because the large towns are on the edge of the basin and do not befoul its waters with their sewage. The Assabet

waters, on the contrary, are polluted beyond the point of safe domestic use.

The Blackstone is *the most polluted river in New England*, occupying a densely-populated valley, and receiving, besides the ordinary sewage, a vast volume of manufacturing waste. The waters sometimes show an acid reaction. The conditions are worse because a great city, Worcester, begins the pollution almost at the source. Still, the value of the river for power more than compensates the loss in other directions.

The Connecticut, up to Hartford, is valuable for transportation. The aggregate power is enormous, and is far short of being utilized, although the power at Holyoke is the largest in this country, except Niagara. The value of the river down to the Massachusetts line is unimpaired for water supply and for ice, but in Massachusetts pollution becomes serious. This does not hold of the western tributaries in that State, the Deerfield and Westfield Rivers, which drain a mountainous and thinly-settled country. The policy of the State, however, is thorough, and warrants the expectation of improvement in the waters of the trunk stream.

The Housatonic is next described; and in this connection interesting extracts are given from decisions of the courts of Connecticut dealing with questions of water pollution, particularly between private riparian owners and cities and towns situated up the streams. The Delaware and the Ohio Rivers are embraced in this report, the latter in much detail. All the basins are illustrated by outline maps of the smaller component basins.

It is shown that, under some conditions of the Allegheny River, sewage poured in at Oil City would reach Pittsburg in fifteen hours, putting out of reckoning all question of "self-purification" between the two cities. Tests of the river water at Cincinnati in 1898 showed that the typhoid bacillus was probably always present. The observer, Mr. Fuller, states:

> From the evidence at hand it is probable that, by taking two cubic centimeters for each test, this germ would be found practically without exception. Upon taking one cubic centimeter for each test the identity of this bacillus was established in 60 per cent. of the samples, as shown by the results of tests.

These results follow in tabular form. The paper as a whole includes all the more important and available records of water examinations in this country, except those in connection with the Chicago Drainage Canal and the Illinois River.

Paper No. 72 in this series deals with Sewage Pollution in the Metropolitan Area near New York City, and is of intense practical

interest. The author is Mr. M. O. Leighton. It is a curious fact that the Raritan, except near its mouth, is quite free from pollution, and most of its tributaries offer safe water for use. The Passaic, on the other hand, is much the most valuable drainage system in New Jersey, and its waters reach in some cases the extreme of defilement. The river is described in detail as to profile, tributaries, amount of discharge, conditions of population, and resulting pollution. Under the last head the facts given are astonishing, and demand attention and action. Municipalities like Jersey City and Newark, which secured other water-supply at great expense, experienced immediate relief from the diseases incident to the use of contaminated water.

Fish have, for the most part, disappeared from the river. The stench arising from the stream, and from the foul matter lodged on its banks, has made parts of the river belt unhealthful and almost uninhabitable. The cities of Paterson, Passaic, Orange, and Newark, and many towns, discharge their sewage into the river. The Passaic Valley Sewerage Commissioners' report is quoted at some length, the extract closing as follows:

> In short, the pollution of the lower Passaic river appeared to the commissioners to be completely established as a public nuisance, an injury to health, and an increasing menace to property interests from the beginning at the Great Falls to below Newark.

The problem was taken up in 1899 by the State Sewerage Commission. Parts of their report show that the sewage is driven in and out along the lower river by the tides, effective flushing taking place only after large rainfall. People living a half mile away from the stream have been forced to close their windows to keep out the stench. Similar conditions were felt from Paterson to Newark Bay, and factory hands in Newark were repeatedly obliged to stop work.

Succeeding pages discuss the loss of values in water supply, ice, fish, and realty. Fixing a low-water rate, the value of the supply equals a principal of over eighteen millions of dollars, which, under existing conditions, is lost. It is partly offset, however, by uses for power. The greatest loss is in realty values. The author cites a 14-acre tract for which $40,000 was refused less than twenty years ago. This piece of land cannot be sold at any price.

The remainder of the paper is devoted to the Hudson and its branches. The reader must turn to the report itself for all but the barest summary. Below Poughkeepsie the water is affected by the salt; hence pollution occasions no loss. From Poughkeepsie to Troy the river is polluted, but its commercial value is more than

compensation. Conditions are not here growing worse, for population is scarcely increasing. There is rapid growth, however, above Troy, both along the main stream and on the Mohawk. These parts are of value for power, water supply, and ice. The Hoosick offers a case of inter-State complications, owing, especially, to the pollution of its headwaters at North Adams. In fact, the waters of this stream are worse where they cross the New York and Vermont line than when they enter the Hudson. The Mohawk, from Rome to its mouth, offers a belt of great increase of population and of serious pollution. Schenectady has abandoned its intakes from the river; but Cohoes, which is below the entire population of this thronged valley, *is still contented to drink from the cesspool of its neighbours.* This is a more aggravated case than that of Troy, which is slowly learning the lesson, but furnished ground for the remark by a sanitary expert before a Senate Committee in the District of Columbia that *up in Troy anything short of soup would be satisfactory.*

The question of pollution is of vast importance in the case of the Hudson, as a source of ice and a possible source of water for Greater New York. Indeed, Mr. James H. Fuertes, in an investigation following the Ramapo job, favoured the adoption of the river supply to be taken out above Poughkeepsie. Other recent titles in the water-supply series are: The Motions of Underground Waters, No. 67; Water Powers of the State of Maine, No. 69; Irrigation Systems of Texas, No. 71; Water Resources of the State of Colorado, No. 74; and Preliminary Report on Artesian Basins in Southwestern Idaho and Southeastern Oregon, No. 78.

Bulletin 213 of the Survey embraces Contributions to Economic Geology, by various authors. Several recently-exploited petroleum fields are here described, including, first, those of California, which are mainly south of the latitude of San Francisco. They lie in the central valley of the State, within the Coast Range, and along the Pacific front. Details of the several districts are given. Of these the Kern River field is the most productive. It is shown in general for the oils of the State that they are developed in strata of late geological age which have been subjected to folding and in some cases to faulting. The total thickness of these beds is at least 20,000 feet, carrying ten or twelve oil horizons. Conditions warrant the expectation that other fields will be discovered, but the supply is plainly exhaustible.

Another of the newer fields is in the neighbourhood of Boulder, in Colorado. This is reported by Professor N. M. Fenneman of

the University of Colorado. Oil springs, due to seepage, have been known for more than thirty years. The first oil was struck in January, 1902. The oil lies in slightly gritty layers of Pierre shale, which often would not be called a "sand" but for the presence of the oil. There is little correlation of the sands at definite levels; hence it would not seem to be possible to predict horizons at which the product is likely to occur. No stratum has been proved to extend for a half mile. "Shooting" has been beneficial in some cases but harmful in others. Eighty-two wells have been sunk to considerable depths in the central and chief part of the field, and thirteen pumps are working regularly. At the time of writing there was daily shipment of two hundred barrels of crude oil. It will thus be seen that the output of the region is as yet relatively small.

Far more extensive are the oil resources of the Texas–Louisiana Gulf Coastal Plain, here reported by Mr. C. W. Hayes. The account is brief, being an advance summary of a Survey Bulletin now in press. The region included is a belt 50 to 75 miles in width, reaching from near the Mississippi River in Louisiana two-thirds across the State of Texas. As in the Boulder field, there is no observed continuity of oil-bearing strata. Small local domes exist in the beds, due to some form of vertical uplift. The oil is associated with these, and they reveal themselves in low hills or broad surface swells. The "pools" are small as compared with central Texas or the Appalachians. Oil was discovered in January, 1901, and within a year and a half there were 280 wells producing from the Spindletop pool at Beaumont. This pool is limited to about 200 acres; and it is suggested that a few well-placed wells would have tapped the supply quite as effectively, and at great saving of expense. Like the oil and gas reservoirs of Ohio and Indiana, the oil rock is a porous crystalline dolomite. The porosity is greater here than in the more northern States, and includes distinct cavities an inch or more across. The author estimates that one-third of the space is occupied by cavities, which means large storage and early exhaustion as well.

"Gushing" is a characteristic feature of the Gulf region, and is due to the expansive force of pent-up gases. The pressure has greatly declined; hence spontaneous flow is followed by pumping, which, in turn, will become unprofitable. In quality the oil resembles that of California rather than that from the Appalachians, and will be used mainly for fuel, having some advantages over coal, especially for locomotives.

Bulletin No. 209 discusses the geology of Ascutney Mountain, Vermont. This is hardly a locality of general geographic interest, and most of the Bulletin is occupied with petrographic and structural facts which have no place here; but the author, Dr. R. A. Daly, draws the interesting conclusion that no such powerful glacial erosions took place in New England as has been proved for the fiord region of Norway or the valleys of Switzerland. Mount Ascutney has no definite stoss-and-lee form, its radiating ravines are deep and of pre-glacial origin, and the "pre-glacial Ascutney had practically the form of the present mountain." That glacial erosion should be large under some conditions and small in others is rational, and helps to explain the opposing verdicts of different observers. What we need is a precise knowledge of these conditions.

The latest volume of Mineral Resources of the United States covers the year 1901. Instead of appearing according to the custom of later years, as part of the Director's annual report, it now stands by itself and goes back to the ordinary octavo form. It is compiled by David T. Day, Chief of Division of Mining and Mineral Resources, and contains 996 pages, giving in text and tabular form brief reviews of all mineral products of the United States.

Of the new series of Professional Papers about a dozen have been received. Nos. 1 and 2 form additions to the already considerable body of Survey literature dealing with Alaska. No. 3 is a detailed report on the Geology and Petrography of the Crater Lake National Park, the senior author being Mr. J. S. Diller, who has already given us briefer but excellent accounts of this now famous region. Papers 4 to 9 deal with forest conditions in various parts of Washington, Oregon, and California. Some of these are lavishly illustrated, and contain a large amount of detailed information. Paper No. 10 belongs also to Alaska; and No. 14 is a somewhat bulky volume, giving a summary of chemical analyses of igneous rocks.

The Twenty-second Annual Report of the Geological Survey is the last to be issued in the old form, containing not only the usual administrative report of the Director, but several bound volumes, mainly of economic material, such as is now appearing under the general title of Professional Papers. Volume 1 contains the Director's Report; and this is followed by Mr. Geo. H. Eldridge in a review of the Asphalt and Bituminous Rock Deposits of the United States. To the average reader the great variety and the wide distribution of the hydrocarbons as a whole will be surprising. They may be gaseous; or fluid, like petroleum; or viscous, like mineral

tar; and thus the conditions pass to elastic, or solid. In their occurrence they may be mixed with limestone, with silica, or sand, or with earthy matter. Many analyses are given, and the inter-gradations and the difficulty of classifications are emphasized. The distribution is described and also delineated upon a map. In one form or another this class of products appears in West Virginia and Kentucky, east of the Mississippi River, and in Arkansas, Indian Territory, Missouri, Texas, Utah, and California, with minor occurences in other States. The localities are then described in detail, with many maps, sections, and views.

Volume 2 contains 888 pages, and is entirely devoted to various ore deposits, containing little that is of general geographical interest. Volume 3 is mainly taken up with a comprehensive review of the coal fields of the United States. Being the latest extended publication on this subject, it has much value as a work of reference, not only from the economic point of view, but also for teachers. Mr. C. W. Hayes gives a brief general introduction, and Professor J. B. Woodworth presents the first in the series of papers—an account of the coal beds of Triassic age, in the Eastern United States, in Virginia and North Carolina. This coal has long been known, and was mined as early as 1775; but it has been so overshadowed by the great Appalachian deposits of Carboniferous age that this Report and even the existence of such coals would be a surprise to most non-geological readers. In pursuance of the general object, to make this Report a complete and trustworthy summary, the other papers, like the first, are prepared by special students of the several fields. The reader is referred to the volume itself for titles, authors, and the great body of facts which can receive no notice here. The same volume includes reports on the Gaines oil field of Northern Pennsylvania, on the Portland Cement Industry in Michigan, and on the chalk of Southwestern Arkansas.

Volume 4 gives 500 pages to the results of stream measurement for 1900. This work is done under the direction of Mr. F. H. Newell, Hydrographer-in-Charge. In the same general field is the report that follows; it is by Mr. Arthur P. Davis, and discusses the Hydrography of the American Isthmus. The author begins with a summary account of the physiography of the isthmus. Temperature and humidity of various stations are given, with rainfall and wind movement. A brief notice is then given of the several canal routes—the Atrato, the San Blas, the Caledonia, the Panama, and the Nicaragua. A comparison of routes makes some interesting parallels, with data from Manchester, Suez, Kiel, and Sault Ste.

Marie. According to our author, no trade between Europe and the Orient will use an American canal, owing to the shorter distance by the Suez route; and even vessels from New York, headed to points south of Hong Kong, will go by Suez or the Cape of Good Hope.

The comparison between Panama and Nicaragua is not without interest, in the uncertainty which still exists. Nicaragua, being in the belt of trade winds, is more favourable for sailing craft; but the proportion of this class of vessels is small, and is likely to be smaller in the near future. Nicaragua would be chosen by sailing ships from the North, about 5 per cent. of the total traffic. Steam vessels from Gulf ports would have little choice between the two routes in reaching the west coast of North America. All others, or 70 per cent. of the whole, would prefer Panama. Steam vessels going to the west coast of South America would save nearly 400 miles by this route. Panama, on the other hand, is unhealthful; while Nicaragua is favourable in this regard, and is itself a region of vast undeveloped resources. This land is the most favourable anywhere to be found in the tropical belt of the world for Caucasian immigration. The opportunity to surround the canal with civilized life of a high type does not exist at Panama. The hydrography of both routes is then studied in detail.

This volume closes with a supplemental report on the High Plains and their Utilization, by Willard D. Johnson. The main body of this report was offered in the 21st Annual, and was reviewed by the present writer in an earlier number of this BULLETIN.

The twenty-third Annual Report of the Survey is the first to be published under the new plan. It is a single volume, giving the administrative report upon work done in the year ending June 30, 1902. The Director gives a short historical account of the growth of the new legislation concerning the arid lands, beginning with Major Powell's well-known report, which was prepared in 1877 and 1878, and coming down to the time when the President's distinctly-affirmed policy and the action of Congress have both expressed and strengthened the popular interest in this question.

As usual, the work of the numerous field parties is briefly described; and it is stated that Mr. C. W. Hayes has assumed the position of Geologist-in-Charge of Geology, and Mr. A. H. Brooks, after wide experience in Alaskan work, has been placed in charge of investigations in that increasingly-important region. There is a résumé of mineral resources, and the progress of the topographic department is given in detail, with progress maps for all parts of

the Territory. The report closes with a memorial of Clarence King (including portrait), Director of the Fortieth Parallel Survey, and first Director of the United States Geological Survey under the present organization. A. P. B.

MR. PEARY'S EXPEDITION TO THE ARCTIC.

Mr. Peary has obtained a three years' leave of absence from the Navy Department, to begin from April 1, 1904. The purpose is to enable him "to undertake an expedition for the attainment of the north pole and to secure general scientific and geographical information concerning the high polar regions." Mr. Peary sent to the Secretary of the Navy, with his application, the following letter explaining his plans:

WASHINGTON, D. C., Sept. 2, 1903.

SIR: Referring to my application for leave of absence accompanying this, I beg to state for your information that I propose to secure a suitable ship, put her into one of our best shipyards, have her reënforced and strengthened to the maximum degree and fitted with American engines, possessing the maximum of strength and power with the minimum weight and space, so that she may go north as an exponent of American skill and mechanical ability.

With such ship I should sail north about the 1st of next July, and on reaching the Whale Sound region should take on board my Esquimaux, establish my permanent sub-base at Cape Sabine, and then force my way northward to my proposed winter quarters on the northern shore of Grant Land, establishing caches as far as practicable *en route*. By the earliest returning light of the following February I should start due north over the polar pack with a small, light pioneer party, followed by a large, heavy main party. I should expect to accomplish the distance to the pole and return in about one hundred days or a little more, an average travel of about ten miles a day. Returning, I should break the ship out late in the same season and return home.

If ice conditions the first year were such as to prevent reaching the northern shore of Grant Land, I should winter as far north as practicable and force the ship to the desired location the following year. In this event the expedition would be gone two years.

This plan is the result of some twelve years of almost continuous experience in those latitudes, and is based upon an extended personal acquaintance with the region from Sabine to 84 degrees north latitude and a thorough familiarity with climatic and other conditions and with Esquimaux.

The distinctive features of my plan are: The use of individual sledges with comparatively light loads, drawn by dogs, giving a travelling unit of high speed and radius of reach, as opposed to the man sledge, with its heavy load, slow speed and limited radius; the adoption of Esquimaux methods and costume and the fullest utilization of the Esquimaux themselves.

The advantage of my plan and route are a fixed land base 100 miles nearer the Pole than on any other route, a more rigid ice pack extending Poleward than is to be found on the opposite side of the Pole, a wider land base upon which to retreat and a well-beaten line of communication and retreat from winter quarters to comparatively low latitudes, which is practicable at any season of the year.

The work outlined above comprises two distinct stages, viz.: The navigation of the ship to the northern shore of Grant Land, the traverse of the Polar pack with sledges from the northern shore of Grant Land to the Pole and return. In connection with the former, four ships (the Polaris, the Alert, the Discovery, and the Proteus) have accomplished this feat. In regard to the second, I have already made four trips in those same regions, in which the average air line distance from start to finish was the same as the distance from Grant Land to the Pole. The air line distance from start to finish of my 1900 sledge journey was such that had my starting point been the northern shore of Grant Land it would have carried me beyond the pole and return.

I beg to state for your consideration the following :

The North Pole is the last great geographical prize the earth has to offer. Its attainment will be accepted as the sign of man's final physical conquest of the globe, and it will always stand as one of the great milestones in the world's history.

The attainment of the North Pole is, in my opinion, our manifest privilege and duty. Its attainment by another country would be in the light of a reproach and criticism.

The sense of all the foremost geographers, practical and theoretical, now converges upon the Smith Sound or "American route," along which I have been working for years past. Other routes have been eliminated. If we delay in preëmpting this route, some one else will step in and win the prize.

I believe that my experience, gained in years of practical work; my special methods of travel and equipment, the evolution of years of practical work; my personal acquaintance with every feature of my chosen route and region, and my command of the full resources and utmost effects of the entire little tribe of Whale Sound hyperboreans, who have lived and worked with me for years, give substantial reasons for anticipating a successful outcome to an expedition based on the above lines.

Very respectfully,

R. E. PEARY,
Civil Engineer, U. S. N.

To this letter Mr. Charles H. Darling, Acting Secretary of the Navy, wrote the following reply under date of Sept. 5:

DEAR SIR : In granting you leave of absence for the purpose of prosecuting your Arctic work, I am moved to remark that I believe you are better equipped than any other person in the country to undertake this work. You have the requisite courage, fortitude and physique. You have had a longer term of service within the Arctic circle than any other explorer. You have had large experience in sledge journeying, both upon the land and upon the polar pack. You are familiar with ice conditions through the Smith Sound route and north of Grant Land and the continent. You have demonstrated your ability to maintain yourself in that latitude for a longer period in health and safety than any other explorer. You have reduced the inconveniences and hardships of the Arctic service to a minimum.

You are conversant with the language and customs of the Whale Sound Esqui-

maux and are personally acquainted with every individual in the tribe. They have become accustomed to your leadership, and if you succeed in transporting the selected hunters and the best families to the north shore of Grant Land, as you propose, you will thereby establish a base which will enable you to live in safety and comparative comfort for an indefinite period.

Grant Land as such base has great advantages over Spitzbergen, Franz Josef Land, or any other known point, in that it has an extensive shore line, which a party retreating from the Pole cannot fail to find, whatever may be the extent of the polar drift.

In establishing a colony of Esquimaux at this point, you thereby establish a self-sustaining base at the nearest practicable point to the Pole. Such self-sustaining base has not heretofore been established in any such high latitude. Your ability to force your ships to a high northing with this Esquimaux colony is all important to your success. Such northing has been made by the *Polaris*, the *Alert*, the *Discovery* and the *Proteus*. There would seem to be no reason why you cannot do the same. Knowledge of ice conditions that has been gained since that time will certainly enable you to provide a ship better adapted to the purpose than either one of these.

The attainment of the Pole should be your main object. Nothing short will suffice. The discovery of the Poles is all that remains to complete the map of the world. That map should be completed in our generation and by our countrymen. If it is claimed that the enterprise is fraught with danger and privation, the answer is that geographical discovery in all ages has been purchased at the price of heroic courage and noble sacrifice. Our national pride is involved in the undertaking, and this department expects that you will accomplish your purpose and bring further distinction to a service of illustrious traditions.

In conclusion, I am pleased to inform you that the President of the United States sympathizes with your cause and approves the enterprise. With best wishes for your health and confidence in your success, I am, respectfully,

CHARLES H. DARLING,
Acting Secretary.

GEOGRAPHICAL RECORD.

NORTH AMERICA.

THE DEVELOPMENT OF THE UNITED STATES.—*Ergänzungsheft* No. 142 to *Petermanns Mitteilungen* is entitled "Die Entwicklung der Vereinigten Staaten von Nordamerika." The writer, Mr. Richard Blum, has prepared numerous tables derived from our Census Reports, some of them extending back as far as the first census, to show the increase in our population in every State and Territory, the elements of which it is composed, the history of immigration, and the growth of our cities. The tables devoted to the chief agricultural crops are full of interest and of suggestive comparison, showing for each State and Territory the number of acres in each crop in the last four census years, the harvest in bushels or tons, the average productivity per acre, the average value per bushel or ton, and the total value. The statistics of live stock and the number and value of farms, farm buildings, and agricultural machinery are treated in the same exhaustive manner. The history of the development of our mining industry, general manufactures, commerce, and merchant marine as shown by statistical tables is admirably presented. The volume concludes with a sheet containing ten maps of the country, showing graphically the territorial growth of the United States, the steady western movement of the centre of population, and the product per acre and the price per bushel or ton of each of the cereal crops, potatoes and hay, in each of the States and Territories for the year 1900. No foreign publication has ever given so complete and intelligible a statement of our economic development and present condition. Each series of tables is prefaced by remarks of an explanatory nature and by deductions from the tables, to which attention is especially called. The work is important, not only as a convenient and authoritative reference book relating to the United States, but also as a contribution to anthropogeography.

THE SCHOOL OF GEOGRAPHY IN THE SUMMER SESSION OF CORNELL UNIVERSITY.—An announcement of this interesting experiment was given in the April number of this BULLETIN. Considering the alarm produced by the typhoid epidemic of last winter, the attendance was large, and the health of the school was as perfect as in any previous year. Teachers from seventeen States were registered

in the School of Geography, representing grade, normal, and high schools and superintendents. Professor R. S. Tarr, the Director of the school, gave courses in Physiography and the Physical Geography of Europe. Professor Albert P. Brigham gave courses upon Dynamic Geology and the Geography of the United States. Commercial Geography was treated by Principal Philip Emerson, of Lynn. Courses dealing more directly with method were given by Dr. C. A. McMurry, upon Type Studies and Home Geography, and by Supervisor R. H. Whitbeck, of Trenton, upon Class Room Problems and Laboratory Methods in the Grades. Laboratory work in Geology was directed by Mr. Geo. C. Matson, and in Physical Geography by Assistant Principal Frank Carney, of Ithaca. The local region was very thoroughly covered by field excursions in Physiography, Geology, Commercial and Home Geography, and longer excursions were made to Watkins Glen, Wilkesbarre, Union Springs, and Lake Ontario. A feature of the school was the round-table conference, held on one evening of each week, for the informal discussions of school problems in geography.

It is expected that this very comprehensive group of courses, with some additions that experience has suggested, will be again offered in 1904, with the same faculty. A. P. B.

Age of the Lansing Skeleton.—Professor N. H. Winchell reenters the discussion of the age of the Lansing skeleton with a paper published in the *Bulletin* of the Geological Society of America (Vol. 14, pp. 133–152). It will be remembered that these human remains were discovered at Lansing, Kansas, in the loess deposits of the Missouri Valley by a farmer named Concannon, who was digging a root cellar. The skeleton was found beneath twenty feet of loess. Professor Winchell contends that the loess found in the Mississippi Valley is of aqueous origin; that the main body of it is contemporary with an ice epoch now known as the Iowan stage of glaciation, and that the skeleton proves the existence of man in the Iowan epoch, or in the fourth of the five glacial stages recognized in North America. It is assumed by glacialists that the fifth or Wisconsin glacial stage occurred at least 8,000 years ago. Professor Winchell says that the bones of the Lansing skeleton were buried by the volumes of mud and muddy water with which the Missouri Valley was filled, and that these sediments were augmented by materials from the Kansas drift.

Building Stone and Coal in Washington.—Vol. II of the Annual *Report* of the Geological Survey of Washington, 1902, is

devoted to two papers, one on the building and ornamental stones of the State and the other on its coal deposits. The granites are all light gray in colour, and are very good building material. The sandstones compare favourably with many of the best quarried elsewhere. Few of the marble deposits have been developed, and most of the promising marble properties, ordinary grades or decorative varieties, are in Stevens County, in the northeast corner of the State. The coal fields are chiefly in the west, extending in a broken line from the Canadian boundary to the Columbia River. Lying on the border, between the foothills of the Cascades and the Puget Sound basin, the fields are within easy reach of tide-water, and have excellent facilities for transportation. The output of the twenty-three coal-mining companies in 1902 was 2,690,789 short tons of coal and 40,569 tons of coke.

Boston Described and Pictured.—The *Journal of Geography* signalized the meeting of the National Educational Association at Boston, in July last, by devoting its June number chiefly to that city. It depicted in an admirable series of articles the approaches to Boston, its geographical features and development, the influences which make it a great industrial centre, and other characteristics of the city. It is rarely that a great metropolis is so fully and adequately described from a purely geographical point of view. As a geographic study of the second greatest seaport of the United States these papers are to be heartily commended.

Exploration in Hudson Bay.—The Canadian Government steamer *Neptune* sailed on Aug. 22 from Halifax for Hudson Bay and Arctic waters. A year and a half will be spent in botanical, geological, and natural history investigations. It is said that the party will take formal possession for Great Britain of the Arctic islands north of this continent and the shores of Baffin's Bay.

Storms of the Great Lakes.—A recent publication of the United States Weather Bureau (Bulletin K, 4to, pp. 9, Charts 952), by Professor E. B. Garriott, deals with the storms of the Great Lakes, and is designed to furnish the observers of the Weather Bureau, and ship captains on the Lakes, such information as will help them to recognize, on the daily weather maps, the general weather conditions attending the approach of storms. There are in all 952 small weather maps, illustrating the more important Lake storms which have occurred during the twenty-five year period 1876–1900. Each storm is illustrated by four charts, covering 32

to 48 hours of its history. Usually, also, at least two of the charts present the general meteorological conditions over the United States and Canada eight to twenty-four hours before the storm centre reached the Lake region. November, with forty-five severe storms, heads the list for greatest monthly storm frequency. In June and August severe storms occur only about once in three years, and in July about once in four years. Thus it is clear that, as the navigation season draws to its close, the storms increase both in number and in severity. The straight gales of summer are an almost negligible quantity as far as forecasting is concerned. The most destructive Lake storms come from the southwest, and usually appear first in the region of the southeastern slope of the Rocky Mountains, the Rio Grande Valley, the coasts of northeastern Mexico, and the western part of the Gulf of Mexico. The season of these southwest storms is from October to May. The storms from the lower Missouri Valley, or "Middle West," are next in order of severity. They appear first on the middle-eastern slope of the Rocky Mountains, or swing southeast from the northwestern States, or the north Pacific coast, and then recurve to the east or northeast. The storms from the middle west are common at all seasons, but the most severe ones occur chiefly in the colder months. "Northwest Storms" include the greater number of the Lake storms. This class takes in all disturbances that move from the northeastern Rocky Mountain slope, and the British Northwest Territory almost directly toward the upper Lakes. During the colder months many of them advance from the north Pacific Ocean. Storms of this type are seldom destructive over the Lake region. The Lakes also suffer occasionally from storms of tropical origin, which have come from the Gulf of Mexico or the South Atlantic coast of the United States. A useful little "wind-barometer table," on page 9 of the Bulletin, shows the kinds of wind and weather indicated in the Lake region, with different heights and changes of the barometer. R. DEC. W.

NATICK DICTIONARY.—The Bureau of American Ethnology has issued as *Bulletin 25* a dictionary of Natick language (XXVIII and 347 pp.). The dictionary is in Natick-English and English-Natick. The language was that of the Natick Indians of Massachusetts, a tribe of Algonquian stock. It was into this language that John Eliot made his famous translation of the Bible (1661–63), and as only fourteen complete copies of his work are now known to exist, they are valued at very high prices. This dictionary is the result of the scientific study of Eliot's Indian Bible by Dr. James Ham-

mond Trumbull, who gave the closing years of his life to the preparation of the vocabularies which are here printed from his manuscript. Dr. Edward Everett Hale, who contributes an introduction to the dictionary, says that the descendants of the Algonquian tribes of Massachusetts have not retained a knowledge of their dialects, but the Passamaquoddy and Micmac Indians of Maine still use their dialect of Algonquian stock.

West Indian Hurricanes.—The August, September, and October issues of the *Pilot Chart of the North Atlantic Ocean*, issued by the United States Hydrographic Office, have frequently contained brief accounts of the class of cyclones known as West India Hurricanes, because these storms occur chiefly during our late summer and early autumn months. The *Pilot Chart* for September, 1903, contains an excellent, albeit necessarily somewhat brief, discussion of West India Hurricanes, prepared by James Page, of the Hydrographic Office (reprinted from Hydrographic Office Publication No. 86, Gulf of Mexico and Caribbean Sea, Vol. I, 5th Ed., 1901). This discussion, while intended primarily for seamen, is not technical, and will prove useful for other persons as well. The path usually followed by these hurricanes carries them from their place of origin, in the northern margin of the doldrums, in a direction between west and north to the northern limit of the trades, and then in a direction between north and east. This path takes most of these storms along, or near, the Atlantic coast of the United States. Occasionally, instead of following this regular track, a hurricane keeps to the westward, across the Gulf of Mexico, before recurving, as was the case with the Galveston storm of September, 1900. The months of maximum frequency of occurrence are September and October. Of 56 hurricanes recorded by the United States Hydrographic Office in the 11-year period, 1890–1900, 41 occurred in these months.

While within the tropics the area of low pressure and violent winds rarely exceeds 300 miles in diameter, in higher latitudes this may be considerably increased. In the old days the "8-Point Rule" was believed to apply to all parts of a tropical cyclone, but now every seaman knows that it is only within the comparatively small area covered by the central depression that the direction of the wind is nearly at right angles to the barometric gradient. Farther out, the wind blows more directly towards the centre, and, although observations on this point differ greatly in different parts of the same storm, and in different storms, six points (67° 30′) may be taken as about the value most commonly noted, although too

much reliance should not be placed on the accuracy of this method of determining the bearing of the centre. The distance of the centre can best be determined by noting the height of the barometer and its rate of fall; the force of the wind; the movements of the clouds, and the rapidity with which the wind shifts. The matter of manœuvering, to keep a vessel away from the dangerous centre; or to get her into the "navigable semicircle"; or to make the best use of the winds on the outskirts of the storm to help her on her course, has been very carefully worked out, and the result of many years of study of hundreds of observations has given the following brief rules for handling vessels in tropical cyclones: In the left semicircle (with respect to the storm track) the wind shifts to the left; lie-to, if at all, on the port tack. In the right semicircle, the wind shifts to the right; lie-to, if at all, on the starboard tack.

R. DeC. W.

HEALTH ON THE ISTHMUS OF PANAMA.—Gen. Henry L. Abbot, U. S. A., discusses the important question of health on the Isthmus of Panama in a recent article on the *Climatology of the Isthmus of Panama* (Monthly Weather Review, XXXI, No. 3, 1903, 117–124). During the construction of the Panama Railroad no health statistics were made public, but they were undoubtedly appalling. At that time the question of acclimatization was not understood nearly as well as at present, and natives of the temperate regions were made to perform hard manual labour under the tropical sun. Now it is known that dependence for such work must be placed on West Indian negroes, because, although white men can supervise in the Tropics, they should not attempt more. During the period of canal construction, and especially during the time of the New Panama Canal Company, careful health records were kept, and the following table, which is a summary of one prepared by Dr. Lacroisade, for many years medical director of the Company hospital at Panama, gives a good idea of the health conditions during the last twenty years:

YEARS.	MEAN EFFECTIVE FORCE EMPLOYED.	MEAN ANNUAL PERCENTAGE OF DISEASE.			MEAN ANNUAL PERCENTAGE OF MORTALITY.		
		DISEASES OF EUROPE.	DISEASES DUE TO CLIMATE.	MEAN TOTAL PER YEAR.	DISEASES OF EUROPE.	DISEASES DUE TO CLIMATE.	MEAN TOTAL PER YEAR.
Old Company, 1881–1888.	10,854	18.83	42.75	62.58	3.05	3.92	5.97
Receiver, 1889–1894.	971	....	....	49.68	....	....	2.88
New Company, 1895–1901.	2,703	....	....	37.17	2.10	0.51	2.61

Dr. Lacroisade attributes the marked reduction in the death-rate to the better accommodations of the laborers, to better drainage, and especially to the fact that the excavations have reached a level below the poisonous emanations of decaying organic matter. He finds that for the last four years, with a personnel of 2,275, the percentage of disease has been 29.65, with a mortality of 2.35 per cent., which he believes do not exceed those on large works in any country. The employees concerned in these latter figures had been on the Isthmus some time, and were well acclimated. Dr. Lacroisade believes that yellow fever is in nowise necessarily endemic on the Isthmus. The completion of sanitary works, the cleaning of streets, and the filling in of many swamps in Colon have evidently been very effective in freeing that city of yellow fever, for since 1891–92 Colon has been free from any infectious disease, and escaped the yellow fever epidemics of 1897, 1899, and 1900. Dr. Lacroisade thinks that by furnishing a good supply of drinking water, constructing sewers, watering and cleaning streets, and establishing effective quarantine, Panama would also have fewer yellow fever epidemics, and a residence there would be less dangerous for unacclimated white men than it is at present.

R. DEC. W.

HANDBOOKS OF THE LATIN-AMERICAN REPUBLICS.—The handbooks relating to the various Latin-American states, which are being compiled by the International Bureau of the American Republics, contain a large amount of recent and valuable information. Their usefulness, however, would be much enhanced if the material used were more carefully sifted and classified. In the latest issue, "Argentine Republic," for example, it is impossible to find in the 375 pages a comprehensive, orderly account of any of the great industries. Some of them are mentioned only in statistical tables. It seems certain that more critical selection of material and more concise and logical treatment of topics would result in better, smaller, and more useful books.

GEOGRAPHIC TABLES AND FORMULAS.—The United States Geological Survey has just issued as *Bulletin No. 214* a compilation of geographic tables and formulas relating to the work of the topographic branch of the Survey. The collection in one volume of this material, which is used by topographers both in the field and the office, will be useful to many.

DEATH OF CIVIL ENGINEER MORISON.—Mr. George Shattuck Morison, the eminent civil engineer, died in New York on July 1,

aged 60 years. One of his last public appearances was before the American Geographical Society in December, 1902, when he delivered an address on the Panama Canal before a large audience, including many distinguished members of Mr. Morison's profession. As a member of the Isthmian Canal Commission Mr. Morison had thoroughly studied the questions relating to the Panama Canal. His valuable paper on the subject was printed in the BULLETIN for February, 1903. Mr. Morison was born at New Bedford, Mass., was graduated from Harvard in 1863, and was especially known for the large number of bridges he had built, including fifteen across the Mississippi and Missouri rivers.

SOUTH AMERICA.

THE RIO NEGRO AND THE CASIQUIARE.—A correspondent asks for information as to the practicability of using the Rio Negro and the Casiquiare bifurcation which connects the Negro with the Orinoco as an outlet for the rubber product of the Amazon basin. Col. George Earl Church, one of the most authoritative writers in English on South America, may be quoted as to the navigability of the Rio Negro:

> The Negro is navigable for 450 miles above its mouth for 4 feet of water, in the dry season, but it has many sand banks and minor difficulties. In the wet season it overflows the country far and wide, sometimes to a breadth of 20 miles, for long distances; and for 400 miles up, as far as Santa Isabela, is a succession of lagoons, full of long islands and intricate channels, and the slope of the country is so gentle that the river has almost no current. But just before reaching the Uaupes* there is a long series of reefs over which the river violently flows in rapids, cataracts and whirlpools. (*Geog. Jour.*, Vol. 17, p. 367, 1901.)

The same writer says in a note on p. 365 of his article that a much shorter connection exists to the west of the Casiquiare between the Orinoco and the Amazon basins by the Isthmus of Pimichin. It is reached from the Orinoco River by ascending the Atabapo and its Terni branch. The latter is somewhat obstructed, but could easily be cleared out and made navigable. The isthmus (that is, the portage between the headwaters of the Terni and the Rio Pimichin) is ten miles across and is much used for the transit of large canoes which are hauled over it and thence, by the little river Pimichin, reach the Rio Negro.

We have found no evidence that the Casiquiare is used for commerce, though its channel is wide and deep. On the Amazon side the difficulties in the rapids of the Rio Negro presumably would

* Also spelled Waupes.

interfere with long-distance transportation through the Casiquiare; on the Orinoco side the whole region has not advanced beyond the stage of pioneer exploration; the Casiquiare itself was not even fairly well known till the Chaffanjon expedition of 1886–1887 made it a subject of special study. Speaking of the Orinoco, Major Stanley Paterson says in his article, "In the Valley of the Orinoco" (*Geog. Jour.*, Vol. 13, 1899, pp. 39–50), that Ciudad Bolivar is practically the western outpost of civilization in that direction and the farthest limit of regular steam traffic on the Orinoco. The prospects that the Casiquiare will be used as a commercial highway between the Amazon and Orinoco basins in the near future do not seem to be important.

Trigonometrical Survey of Brazil.—The Brazilian Government has decided to begin a survey of the country on modern scientific lines. Preparations were being made in June for the triangulation of the State of Rio Grande do Sul by a commission under Colonel F. de Abreu Lima, who intended to measure bases at Porto Alegre and Uruguayana and to connect the two cities by triangulation. This arc will cover about 6.25° of longitude in 30° south latitude.

Climatic Charts of Argentina.—Dr. Josef Chavanne has recently issued an important publication on the temperature and rainfall of Argentina (Vol. I of the Publications of the German Academic Association of Buenos Ayres). The rainfall records are reduced to the period 1861–1900, and the temperature records to the period 1856–1900. The charts show the annual and seasonal temperature and precipitation, and the temperature ranges and anomalies. The country is divided, climatically, into five general provinces, three of which are subdivided into two sub-provinces each.

R. DeC. W.

Paraguay Review.—This publication, issued every three months by the Government of Paraguay, is devoted chiefly to the economic aspects of the country and the information required by immigrants. With the beginning of its third year in March last, all the contents of the magazine are printed in English and German instead of English and French. The change is made on account of the growing demand for information about the Republic in the German language.

EUROPE.

THE BERLIN GEOGRAPHICAL SOCIETY.—The completion of the seventy-fifth year of the existence of this Society was celebrated on May 4 last. As the anniversary nearly coincided with the seventieth birthday of the distinguished German geographer Baron von Richthofen, the two celebrations were combined. Prof. Hellmann gave an address reviewing the history of the Society, which he divided into three characteristic epochs. In its early days, from 1828 to 1859, it was concerned chiefly with the diffusion of knowledge of geographical work done elsewhere, and discussion of the results obtained. The year 1859 was marked by the opening of a period of great exploring activity on the part of the members of the Society—a feature that especially characterised its work during the second period. The third period, while continuing explorations on a large scale, as, for example, in the Antarctic, has been marked by more intensive geographic research, in the form of the detailed examination of smaller areas, and investigation of special problems. In this period, also, there has been continuous improvement in the value of the Society's publications, and eight volumes of the "Bibliotheca Geographica," which is regarded as a model of bibliographical enterprise, have been published. A new feature, which will still further contribute to the usefulness of the Society in the future, is the foundation of the "Ferdinand von Richthofen Stiftung," in honor of the great geographer. The sum of 26,000 marks, which the committee had collected, was handed over to Baron von Richthofen as a fund for the encouragement of geographical progress, the yearly proceeds to be devoted to the support of journeys, of geographical research, grants to geographical students, and other similar purposes.

ASIA.

RAINFALL OF INDIA.—India is one of the most interesting countries in the world from a climatic standpoint, especially as regards its rainfall. Cherra Punji, in the Khasi Hills, north of the head of the Bay of Bengal, has long been celebrated because of its having the heaviest rainfall in the world, 457.80 inches, according to the latest data available. Furthermore, the year in India is divided into three seasons—the cold, the hot, and the wet—with the general rains during the summer monsoon, the dry season during the winter monsoon, and finally the storms of the winter rains in northern India, which give winter weather types not very unlike many of

those in the United States. The late H. F. Blanford, in Appendix A of a memoir on the Rainfall of India (*Indian Meteorological Memoirs*, Vol. III), gave the monthly rainfalls for 457 Indian stations for various periods ending with December, 1886. In the latest publication of the Indian meteorological service (*Indian Meteorological Memoirs*, Vol. XIV. I. The Rainfall of India. 1902. Fol. Pp. x+709), Sir John Eliot has reprinted these data, and has brought them down to date by the inclusion of similar data for the fourteen years 1887 to 1900. The latitudes, longitudes, and altitudes of the stations have been corrected, and two columns have been added, headed "Total N. E. Monsoon, December to April," and "Total S. W. Monsoon, May to November." These two periods cover roughly the two rainfall periods of the year—*i. e.*, the cold weather or winter rainfall, and the southwest monsoon rainfall period. In the Introduction reference is made to the very natural objection which is likely to be urged against the use of the term "N.E. Monsoon," which really applies only to the rush of vapour-laden northeast winds along the eastern coast of India during October to December. But popular usage has so firmly established this nomenclature that its retention is justifiable. The term "S.W. Monsoon" has always been a legitimate one, as these winds prevail more or less generally over the whole country from June to September, and in southern and coast districts during October and November also. The present publication, embracing over 700 pages, gives the latest and most authentic data regarding Indian rainfall, and will, therefore, for some years to come, be the source of information on this subject. The series of *Indian Meteorological Memoirs*, which has already contained very many important contributions to meteorological science, shows no signs of diminishing in value as time goes on.

R. DEC. W.

THE PHILIPPINE WEATHER SERVICE.—Part II of the *Report of the Director of the Philippine Weather Bureau, 1902*, concerns "The Meteorological Service of the Philippine Islands," and was prepared by Father Marcial Solá, S. J., Secretary of the Philippine Weather Bureau. The Report is published under the seal of the Department of the Interior, at the Bureau of Public Printing, Manila (4to. Pp. 68. Figs. 12. Pls. VIII). Meteorologists have long known of the excellent work done by the Jesuit priests at the Manila Observatory, especially in connection with the study of typhoons; but the American public knows little of this institu-

tion, which has now become the central station of the Philippine Weather Service, and is carrying on that service by authority of the United States Government.

The Manila Observatory began its work in 1865, at the college known as the Ateneo, under the direction of the Jesuit Fathers, and with a few of the most indispensable instruments. Monthly and annual leaflets were issued from the start, giving the results of the observations. Father Federico Faura, S. J., was the first director, and under his enthusiastic leadership the instrumental equipment was soon increased, and in 1870 the publication of a monthly Bulletin was begun. On July 7, 1879, the first typhoon prediction was issued, and was fully verified by the storm which followed. In 1880, after Manila had been connected with Hong Kong by cable, typhoon warnings began to be sent to the latter station, at the request of the Governor of the colony. In 1884, as the result of representations made by prominent persons, official and otherwise, in Manila, a Royal Decree was issued, officially establishing a meteorological service in the island of Luzon, with secondary stations reporting to the central station at Manila, the director and sub-director (Jesuit Fathers) of the central observatory being paid for their services, and an additional appropriation being made for other expenses. The secondary stations were established and equipped as soon as possible, earthquake records being kept at all these places. The central station having outgrown its old quarters, a new building was erected and was occupied in July, 1886. This building is in the suburb of Manila known as Ermita, on slightly-elevated ground, near the sea, with an unobstructed horizon. The magnetical department, in its own building, was inaugurated in 1888, and the astronomical department, which also has its own building, was completely equipped in 1898.

During the war with Spain the work at the central observatory at Manila suffered no interruption. After the war, as the result of conferences between the members of the Philippine Commissions, the Secretary of Agriculture, the Chief of the Weather Bureau, and the Jesuit Fathers, the Philippine meteorological service was finally established in May, 1901, with Father José Algué, S. J., as director, the director being subject to the Colonial Government in the Philippines in the same way as the Chief of the United States Weather Bureau is to the Secretary of Agriculture. The officers of the Philippine Weather Bureau are a director (salary $2,500); three assistant directors (salary, $1,800); and one corresponding secretary and librarian (salary, $1,400). There is also a corps of

paid observers. After the war the secondary stations provided for in the new act establishing the Philippine Weather Bureau were organized as rapidly as possible. At the present time there are in operation: 1 central observatory; 9 first, 25 second and 17 third-class stations and 21 rainfall stations. A crop service, similar to that in the United States, was begun in August, 1901.

The report contains half-tone pictures of the Manila Observatory, and of various meteorological instruments. Plate VII, "The Special Pavilion for Tropical Regions," is of particular interest. There are also some views of different meteorological stations, shelters, etc., and a map showing the locations of the secondary stations. A list of the publications of the Manila Observatory, 1865–1902, occupies two pages. Among the recent publications the most important are, perhaps, "Baguios o Ciclónes Filipinos" (1897); Las Nubes en el Archipiélago Filipino (1899); "Climatología de Filipinas" (1900); and "The Climate of Baguio" (1902). Two valuable instruments have been invented by the Fathers at Manila—one the aneroid barometer of Father Faura, and the other the baro-cyclonometer of Father Algué. R. De C. W.

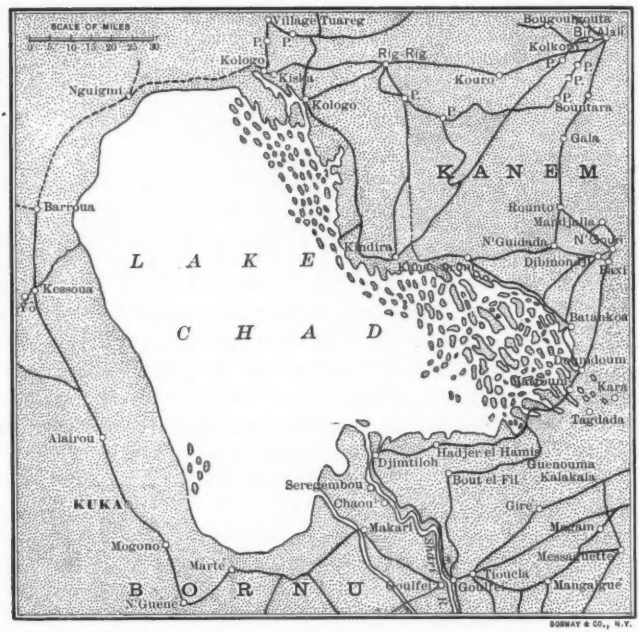
The Late Dr. Ziegler's Scientific Observations. — The "Physikalischer Verein zu Frankfurt am Main" could pay no higher tribute to the memory of the late Dr. Julius Ziegler than to devote, as it has done, a large part of its *Jahresbericht* for 1901–1902 to the publication of the results of his meteorological and hydrographic observations in the neighbourhood of that city, extending over a period of thirty-six years until within a few weeks of his death on Sept. 15, 1902.

AFRICA.

Standard Time in South Africa.—The Governments of Cape Colony, Natal, Transvaal, Orange River Colony, Rhodesia, and Portuguese East Africa, having decided to adopt a standard time for railroads, telegraphs, and other public purposes, have agreed that the time shall be that of the meridian 30° E. Long.—that is to say, two hours in advance of Greenwich time. The arrangement took effect from March 1 last.

Lake Chad.—*La Géographie* published in its number for June a map, "Iles du Tchad et Côte du Kanem," on a scale of 1:500.000, or 7.8 statute miles to an inch. The scale is sufficiently large to show all the numerous islands recently discovered along the whole

extent of the east side of the lake. The map is the combined result of surveys of eleven officers of the French military force in that region under the direction of Lieut.-Col. Destenave; and the map was prepared by Captain Bézu. Colours serve to differentiate the islands into low, wooded, and tilled islands and sandbanks. The geographic co-ordinates were determined for five places among the islands and for Djimtiloh, on the Shari River. A summary description of the islands, based upon the surveys above mentioned, was



LAKE CHAD.

printed in the BULLETIN, 1903, No. 2, p. 187. The map contains an inset map of Lake Chad showing the important changes which the surveys have made in the outline of the great lake and also giving an excellent idea of the distribution of the islands discovered and surveyed. The map here given is based upon the inset map published by *La Géographie.*

The islands which fringe the east coast are due to the currents and prevailing winds, which have carried and distributed enormous quantities of sand. They extend with great regularity from north-

west to southeast. The mainland does not touch the open water throughout the whole eastern side of the lake. The width of the zone of islands varies from about 5 to nearly 20 miles. The channels between the islands rarely exceed 2 miles in width, and in many places are much narrower. Many of the islands are merely sandbanks, while others are occupied by forests or plantations. The actual shore of the lake is largely cut up into peninsulas, which reproduce the trend of the islands.

THE SURVEY OF VICTORIA NYANZA.—Commander Whitehouse, who, some time ago, completed an admirable survey of the shores of the Victoria Nyanza within the British sphere, north of 1° N. Lat., is now engaged under an agreement with the German authorities in a survey of the southern half of the lake, particularly in the interests of steam navigation. The steamer *Winifred*, recently placed on the lake, has circumnavigated it, and it is intended to establish a regular service between ports on all its shores. When this enterprise is carried out it is expected that the quickest route to Lake Tanganyika will be by the Uganda railroad and the Victoria lake. It is probable that Commander Whitehouse's survey of the lake will make important changes in the outline of its southern shores.

FAILURE OF THE MACMILLAN EXPEDITION.—The well-equipped expedition under Mr. W. N. Macmillan of St. Louis, which went to Abyssinia to descend the Blue Nile from Lake Tsana to the plains of the Sudan, was wrecked in the rapids of the river, on the Abyssinian highlands, soon after it started, on June 26, on the river journey. Two of the iron punts that carried the party were lost in the rapids. The occupants swam ashore, but, unfortunately, the lost punts contained the larger part of the stores, and further loss was suffered from a hurricane during the enforced detention of the expedition on the river banks. The party was compelled to return to Addis Abeba, and the journey has been abandoned for the present.

ANTARCTIC.

THE GERMAN ANTARCTIC EXPEDITION.—The German expedition on the steamer *Gauss* has returned home. The *Gauss* sailed from Kiel on Aug. 11, 1901, and arrived at Kerguelen Island, its Antarctic base, on Jan. 2, 1902. Dr. J. Enzensperger had preceded the *Gauss* on the supply steamer *Tanglin*, which carried all the material for the buildings to be erected on Kerguelen and the larger

part of the supplies which the *Gauss* was to take south. On Jan. 31, last year, Dr. von Drygalski and his comrades on the *Gauss* left Kerguelen Island for their journey into the unknown Antarctic. Dr. von Drygalski's official report was published on July 10 as a supplement to the *Reichsanzeiger*. Pack ice was reached on Feb. 13 in 61° 58′ S., 95° 8′ E. The *Gauss* sailed directly over the spot where Wilkes supposed that he saw the land which he designated "Termination Land." Wilkes was 60 miles from the place, and Dr. von Drygalski believes that the American sailor's mistake was due to the deceptive appearance of the icebergs. Seven days later, Feb. 21, 1902, the Germans discovered land. They were in front of a coast covered with heavy ice, evidently the edge of an ice-sheet extending over a land-mass. On one side was a bare volcanic peak rising to a height of 1,200 feet above the sea. The new coast was named Kaiser Wilhelm II. Coast and the little mountain was called Gaussberg. The next day the ship became frozen in the ice in a large bay on this coast, which was named Posadowski Bay. The party were imprisoned here for nearly a year till Feb. 8, 1903, their position being latitude 66° 30′ S., longitude 90° E. The extent of the land-mass was not discovered. Four sledge journeys, however, were made to the coast. The Gaussberg was ascended and found to be the only part of the land in sight not covered by ice. Photographs were taken, the geology of the mountain was studied, and an ice hut was built at its foot, and zoological, botanical, and geological specimens were collected. Better views of the surroundings were obtained in clear weather by balloon ascent to a height of 1,600 feet. The Gaussberg was the most conspicuous object. The edge of the coast could be traced far away to the east and west, and the undulating ice-covered surface stretched away to the south.

The party dredged the sea for marine life and regularly took magnetic, meteorological, and other scientific observations. When the results are worked out it will doubtless be seen that this expedition has added largely to the scientific knowledge of the Antarctic. During the winter months (from the end of April to the end of August) one snowstorm followed closely on another, especially in May and August, burying the ship, so that after each storm it had to be dug out of the snow. The rounds of the meteorological and other observers to obtain the instrumental records were exceedingly toilsome. The party saw two species of penguin, the small Adelia and the Emperor penguin, which were very useful for food, especially for the dogs. Seals were easily caught on the ice. The auxili-

ary party left on Kerguelen Island were most unfortunate. Dr. Enzensperger, the meteorologist in charge of the station, and several of his comrades, perished of beri beri. The station was abandoned in March last and the survivors arrived in Sydney on April 16.

THE NORDENSKIÖLD ANTARCTIC EXPEDITION.—The steamer *Antarctic*, having on board the expedition commanded by Dr. Otto Nordenskiöld, left Sweden in October, 1901, and went to Staten Island, Tierra del Fuego, where the Argentine Government had established a magnetic observatory for co-operation with the Antarctic expeditions. The party left Staten Island on Jan. 6, 1902, for Graham Land. Entering the channel, first shown by D'Urville, on the west side of Louis Philippe Land, they made an interesting discovery. Louis Philippe Land has been supposed to be an island, and is so represented on the maps; but it proved to be only the extremity of the land-mass known as Graham Land. On Feb. 12, 1902, Dr. Nordenskiöld reached Admiralty Inlet, on the coast of Graham Land, and began to prepare his winter quarters. He expected during the following fall and spring months to make sledge journeys over the land and extend knowledge of that region farther south. The *Antarctic*, leaving him and his five companions at their winter quarters, returned to South America with the news above outlined. In November last, about the beginning of the Antarctic summer, the vessel sailed south again, and it was the distinct plan that she should return with the entire expedition in February last. She did not return according to the programme, and, therefore, steps are being taken to send out a relief expedition.

RELIEF EXPEDITION TO VICTORIA LAND.—The British Admiralty is bearing the entire cost of sending a relief expedition to the Antarctic ship *Discovery* at Victoria Land. The supply ship *Morning*, which last season visited the *Discovery* in the neighbourhood of Mounts Erebus and Terror, will sail from Hobart this year instead of from Lyttelton, New Zealand, as before. All letters and parcels for the *Discovery* should reach the *Morning* at Hobart before December 1 next. The sealing vessel, the *Terra Nova*, purchased in Newfoundland, has been fitted for the voyage, loaded with stores, and will accompany the *Morning* as an additional precaution against possible mishap. If it is found impossible to extricate the *Discovery* from the ice in which she was frozen last year in time to return early in 1904, the entire party on that vessel will be brought home on one or other of the relief ships.

ECONOMIC GEOGRAPHY.

THE BREMEN STATISTICAL OFFICE.—Bremen maintains a statistical office, one of whose publications, the *Jahrbuch für Bremische Statistik*, is wholly devoted to the commercial interests of the port. That this phase of Bremen's activity is most thoroughly analyzed and reported may be inferred from the fact that the *Jahrbuch* for 1902 contains 327 large and closely-printed pages. Among these statistics are the number of vessels entering or leaving the port and its outports, with net tonnage, and value of cargo and the countries to which they are destined or from which they come, the quantity and value of each article imported or exported, whence derived and its destination, and the countries which have a share in the commerce of Bremen, with the quantity and value of every article imported from or exported to them. The index makes it easy to ascertain the total import or export trade in every article, and the share in the trade of each country. Thus the four and one-half pages given to the import trade from the United States show that 223 different commodities were brought into Bremen. The value of Bremen's imports from the United States in 1902 was 394,845,738 marks; exports to the United States, 92,581,446 marks. The *Jahrbuch* is a model for works of its kind.

FOREIGN TRADE OF CHINA IN 1902.—The official *Report on the Trade of China for 1902* (Imperial Maritime Customs, Shanghai, 1903) gives the imports at 315,363,905 haikwan taels (a haikwan tael was worth 63 cents American gold in 1902), and exports, 214,181,564 haikwan taels. Since 1890 the imports have increased every year, excepting in 1900, and the exports have shown steady increase, except in 1896, 1898 and 1900. The imports have much more than doubled since 1890, and the exports have nearly trebled. Hong Kong, Great Britain, Japan, the United States, India, and Russia figured most largely in the trade in this order.

CUSTOMS DISTRICTS AND LIGHTHOUSES IN CHINA.—The Inspector General of Customs at Shanghai has just published the revised list of the lighthouses, buoys, and beacons on the coasts and rivers of China, the pamphlet including 9 charts showing position and kind of lights and limits of Customs districts. In China proper there are 17 Customs districts and 9 lighthouses.

ARGENTINE WOOL.—France continues to be the largest consumer of Argentine wool. In the fiscal year 1901–02 Argentina exported 505,086 bales, of which 225,000 bales entered France through the

ports of Dunkirk, Havre, and Marseilles. Germany received 127,000 bales through Hamburg and Bremen; Belgium 78,000 bales, and England 35,000 through Liverpool and London. The exports to North America were 34,000 bales.

ARGENTINE FOREIGN TRADE IN 1902.—The imports of Argentina in 1902 were valued at $103,039,256 in gold, a decrease of $10,920,493 as compared with 1901. The exports were $179,486,727 gold, an increase of $11,770,625 as compared with 1901. The leading imports in order of value were: textiles, $29,744,239; iron manufactures, $17,916,082; pottery, $10,908,694; provisions, $10,626,004; wood and wood manufactures, $6,856,776; beverages, $5,583,549. The purchases from Great Britain were worth $36,955,460; Germany, $13,229,275; United States, $13,303,504; Italy, $12,265,003; France, $9,243,071; Belgium, $5,484,233; Brazil, $4,583,645. The largest buyers of the meat, grain, hides, and other products of Argentina were: Great Britain, $35,084,066; France, $29,587,457; Germany, $22,939,881; Belgium, $13,760,219; United States, $10,037,576, and Brazil, $8,368,742. (*Revista Financiera y Comercial*, Buenos Aires, Feb. 6, 1903.)

RAISING CROPS IN THE FAR NORTH.—Mr. N. L. Skalosubof, addressing the recent agricultural convention at St. Petersburg, said that many facts may be given to disprove the popular idea that grain will not ripen north of 60° N. Lat. A clergyman at Yugansk, Siberia, 61° N. Lat. and 73° 40′ E. Long., is building a mill propelled by wind-power to turn his winter rye and spring wheat into flour. At Masau, on the Pelym River, in 61° N. Lat., a farmer has extended his area under tillage, so that he now raises all the grain required by his large family, and has a surplus to sell. The efforts to raise rye at Beresof in 63° 54′ have been very successful. Still farther north, in 64° 13′, barley, rye, and oats have been grown for a series of years, and yield fifteenfold. Vegetables are raised at the most northern line of Russian settlements—for example, at Obdorsk in 66° 31′, where the successful experiment was first made in 1894.

GENERAL.

GEOGRAPHEN-KALENDER.—Justus Perthes has begun the publication, at Gotha, of an annual "Geographen-Kalender," a reference book of about 450 pages, which promises to be very useful to all geographic workers. Its timeliness and usefulness may be seen from the following enumeration of the more important depart-

ments: Geographical tables, such as those for finding the value of map scales, or for expressing thermometrical records in terms either of Fahrenheit, Celsius, or Réaumur; an enumeration of the chief geographic events, the results of exploration, the geographic literature, and geographic education in 1902; a list of geographers who died in 1902; the latest statistical information from all lands, and, finally, an address book containing the names, geographic specialties, and addresses of about 5,000 workers in this field. The volume ends with sixteen handsome little maps, illustrating, cartographically, the most important geographic events of 1902. Dr. Herman Haack is the editor, his assistants being Dr. Wilhelm Blankenburg, Professor Paul Langhans, Professor Paul Lehmann, and Hugo Wichmann. Next year's edition is to contain a list of geographic societies and publications.

Bibliotheca Geographica.—Vol. VIII of *Bibliotheca Geographica*, published by the Berlin Geographical Society, and compiled by Mr. Otto Baschin, is a practically complete index to the geographic literature and cartographic products of 1899. It contains 511 pages, the volume for 1897 having 444, and that for 1898 478 pages. The regular growth in size of the annual volumes of this most helpful bibliography indicates both enlargement of the quantity of geographic material and the increased thoroughness with which Mr. Baschin, year after year, has covered this prolific field. No necessity has arisen for changing in any volume the excellent classification adopted for the first of the series. Perhaps the only noteworthy improvement in Vol. VIII is the greater completeness with which the Russian titles are treated. As in Vol. VII, thirteen pages are devoted, in the section on Special Geography, to the United States. The classification and the indices of subjects and authors make it easy to find the references to every branch of geographic products. The Berlin Geographical Society and Mr. Baschin undoubtedly have the thanks of all geographic workers for this very useful reference book.

Spherical Maps and Reliefs.—In a paper read before the Royal Geographical Society on April 2 last, Professor Elisée Reclus deprecated the use of maps on different scales, because it is quite impossible to compare them. The maps of Java, for example, are always small and the maps of The Netherlands are large, which causes confusion in one's mind. In all well-conducted schools globes should be used and children should be forbidden to use maps. To show a globe of huge dimensions is impracticable; but

we may at least show slices of the superficial part of the earth, and the effect is the same. If, for example, we should wish to make a globe in a proportion of 1:5,000,000, it would be eight metres in circumference—too large for an ordinary room. But if we cannot have the whole globe, we may have slices of it, and then see places as they are. It would take nearly 150 slices to complete the whole globe; but 50 would represent all the continents, while the remaining 100, representing the water, would be less useful. As these slices of the globe would be only in the proportion of 1:5,000,000, it would be impossible to show relief otherwise than by colours or shades. True relief begins to be visible by slight asperities only when the proportion is from 1:1,000,000.

With regard to relief maps, the speaker said that in a reproduction of Mont Blanc in relief with the proportion of 1:100,000, the mountains would be about four centimetres above the plains. The heights would not be increased more than the breadth and the length of the country, but would exactly conform to the truth. It is wrong for makers of relief maps to show a relief which is not true in proportion. It is absolutely necessary to have an idea of geological shape. It is, therefore, essential to know the slope; but if we heighten the slope, it is impossible to imagine the reality. We get a false idea of the true shape of the country represented. If we wish to show the truth, we must give the proportions exactly as they are in nature. M. Reclus exhibited a model of one of the most precipitous parts of Belgium. This had been stamped out of copper by Mr. Patterson, an Englishman living in Belgium. Every point, M. Reclus said, was in its true position; the whole was true to nature, and such reliefs, he was sure, were a great improvement upon the reliefs ordinarily made, because less difficult to construct, cheaper, and more lasting. (Condensed from the *Geog. Jour.*, Sept., 1903.)

Syllabuses of Instruction in Geography.—The Council of the Royal Geographical Society received requests from the London School Board and the Oxford and Cambridge School Examinations Board to appoint a special committee to draw up syllabuses, as guides to instruction in geography in elementary and secondary schools. The committee requested Mr. T. G. Roper, the Government Inspector of Schools, and Mr. H. J. Mackinder, Reader in Geography at Oxford University, to draft two syllabuses—one for elementary and the other for higher schools. Owing to the death of Mr. Rooper, Mr. G. G. Chisholm completed the revision of the

elementary syllabus. The syllabuses have now been issued by the Society, in a pamphlet of seventeen pages.

The elementary syllabus deals with the preliminary stage of instruction for children between five and eight years; the foundation for systematic study for children between eight and eleven years old; geographical observations, the use of globes and maps, and systematic study of various parts of the world for children from eleven to fourteen years old. The syllabus for higher schools gives outlines of work for a four-years' course.

Having been prepared by educators of large experience, and then thoroughly discussed and, in some respects, amended by the Committee, they undoubtedly contain many suggestions of value for teachers.

A NEW WORK ON BERMUDA.—The Connecticut Academy of Arts and Sciences has devoted its entire centennial volume (Vol. XI, Part II) to the work of its President, Professor Addison E. Verrill, of Yale, on the Bermuda Islands. The volume, which contains over 500 pages, especially emphasizes natural history, while treating also the scenery, climate, products, geology, people, and history of these beautiful islands. In text and illustrations the book is comprehensive and accurate, and is well adapted for a standard work of reference on the subject, and also to meet the needs of many visitors who are interested in the vegetation, the unusual forms of animal life, the grottoes, and many other aspects of the islands.

SHEETS OF THE UNITED STATES ATLAS.

BY

HENRY GANNETT.

During the past year the U. S. Geological Survey has issued eighty-six additional sheets of the great atlas of the country which it is preparing. These sheets are widely scattered over the United States, nearly half the States and Territories being represented upon them.

In the State of Maine are four sheets, all on the scale of 1:62,500, and with contour intervals of 20 feet. These sheets, known as the Orono, Castine, Bangor, and Bucksport, represent country bordering on Penobscot River near its mouth. They show a region of

broken, rocky hills and drumlins, with interrupted drainage, marshes, and lakes—a typical glaciated country.

The result of co-operation between the State of New York and the U. S. Survey is shown in the fact that no fewer than 20 sheets in this State were published during the past year. All of these are on a scale of 1:62,500, with a contour interval of 20 feet. Of these, four are in the northern part of the State, bordering on the St. Lawrence River, west of the Adirondack region, and show a country of low relief, which is mainly composed of glacial deposits. In this region the direction of the glacial movement was evidently southwestward, as is indicated by the trend of the deposits. In the Adirondacks is one sheet, Big Moose, showing a country of scattered, irregular hills, with many lakes and swamps and an interrupted drainage, the hills having a general northeast and southwest trend. On the upper Hudson, in the southern portion of the Adirondacks, is the Luzerne sheet, showing a region of rounded, irregular hills, with little apparent system. In the southern part of the State are the Norwich and Owego sheets, which show a deeply-dissected plateau, traversed by the Susquehanna River and its branches.

Seven sheets—Canandaigua, Naples, Hammondsport, Richfield Springs, Genoa, Pennyan, and Westfield—are in the Finger Lake region, or the western part of the State. Canandaigua and Naples represent the Canandaigua Lake and its surroundings. Hammondsport and Pennyan represent Lake Keuka and other small lakes in its neighbourhood; Richfield Springs the greater part of Otsego Lake; Genoa a large portion of Cayuga Lake, while Westfield lies upon the shores of Lake Erie, and shows the northern bluff of Alleghany plateau. The glacial origin of the lakes is beautifully developed on the maps, showing the smooth glacier-cut walls, as yet scarcely notched by streams.

The Kinderhook sheet represents country in the eastern part of the State, characterized by irregular or broken hills. The Broadalbin lies just north of the Mohawk Valley, and shows a country broken in the northern part; while the southern part has slight relief, and is traversed by the Sacandaga River in a circuitous course, with extensive marshes in its valley. The Cortland sheet lies in a deeply-dissected plateau in the central part of the State. On Long Island are two sheets, Northport and Babylon. These, together, show an excellent section across this morainic island, the northern portion being largely composed of broken hills, while the

southern part is a gentle slope to a low, marshy coast, outside of which are sandbars and marshy islands.

In Pennsylvania are five sheets, all on a scale of 1:62,500, with a contour interval of 20 feet. Of these Slatington, Boyertown, and Wernersville are in the eastern part of the State, and show a country of broken, irregular hills of no great relief. The Mercersburg and Everett sheets, on the other hand, lie in the main within the region of the Appalachian ridges, and illustrate excellently their characteristics. On the former are two beautiful canoe-shaped valleys, and on the latter the deeply-incised course of the Juniata River is a very interesting feature.

In Maryland are four sheets, on a scale of 1:62,500, with a contour interval of 10 feet—Deal Island, Bloodsworth Island, Crisfield, and Nanticoke. All of these are upon the eastern shore, and represent country of very little relief and extensive coast marshes—a land in process of sinking.

In North Carolina are three sheets—Parmele, Tarboro, and Kenly. All these sheets are upon a scale of 1:62,500, the two former having a contour interval of 10 feet, the last of 20 feet. All these sheets show a plain of very slight relief, with crooked, winding streams bordered by marshes.

In West Virginia there are five sheets—Milton, Fairmount, Clarksburg, Wheeling, and Guyandot—all on a scale of 1:62,500, with a contour interval of 20 feet. They lie in the western part of the State, and show the lower slopes of the Alleghany plateau, which is here very deeply dissected with irregular drainage.

In Alabama is one sheet, Wetumka, on a scale of 1:125,000, and a contour interval of 50 feet, situated in the central part of the State. It represents a portion of the course of Coosa River. It is a region of no great relief, but with hills rising generally from south to north.

In Ohio are three sheets—Canton, Fostoria, and Oberlin—on a scale of 1:62,500, the first having a contour interval of 20 feet, the last two 10 feet. The country represented upon these sheets is extremely level, with but little relief, and that due to glacial deposition.

Work has been commenced on an extensive scale in the State of Indiana, which has heretofore been almost neglected by the Survey, and among the sheets are eight in this State. Seven of these—namely, St. Meinrad, Petersburg, Velpen, Boonville, New Harmony, Haubstadt, and Princeton—are on a scale of 1:62,500, with contour intervals of 20 feet; while the eighth, Ditney, is on

a scale of 1:125,000, and also with contour interval of 20 feet. All of these sheets are in the southwestern part of the State, and show country of no great relief, but with broad valleys along the Wabash and White Rivers.

In Kentucky is one sheet only, Tell City, on a scale of 1:62,500, with a contour interval of 20 feet. Across this sheet from east to west flows the Ohio River, leaving a narrow strip of Indiana along the northern border.

In Wisconsin are two sheets, Briggsville and Geneva, on a scale of 1:62,500 and a contour interval of 20 feet. These sheets illustrate irregularly-deposited glacial detritus, with many lakes and marshes and interrupted streams.

In Iowa is one sheet, Winthrop, on a scale of 1:125,000 and contour interval of 20 feet. This is situated in the eastern part of the State, and shows a somewhat broken prairie country.

In Missouri are four sheets, all on a scale of 1:125,000, with contour intervals of 20 to 50 feet. These sheets are Edina and Kahoka, in the northeastern corner of the State, and Sullivan and O'Fallon in the eastern part. The last show a portion of the valley of the Mississippi River and the lower Missouri.

In Arkansas is one sheet, Camden, on a scale of 1:125,000, with a contour interval of 50 feet. This shows a part of the course of the Ouachita River, with the extensive low lands bordering it.

In Indian Territory is one sheet, Lukfata, on a scale of 1:125,000 and contour interval of 50 feet. This sheet is situated in the Choctaw Nation, and represents a part of the Ozark Mountains.

The Gainesville sheet lies in part in Texas and part in Indian Territory, on a scale of 1:125,000, with a contour interval of 50 feet. It is traversed from west to east by Red River, which sweeps across it by a very circuitous course, with great bends.

In western Texas, El Paso County, there is one sheet, Cerro Alto, on a scale of 1:125,000 and contour interval of 50 feet. This shows a desert country, no flowing water being found upon it. The features are the irregular, volcanic Hueco Mountains, with Cerro Alto as the culminating point.

In Nebraska is one sheet, Weeping Water, on a scale of 1:125,000 and contour interval of 20 feet. This sheet lies south of the Platte, in the eastern part of the State, showing a rolling prairie country.

Arizona has one sheet, Bradshaw Mountains, on a scale of 1:125,000, with contour interval of 100 feet. This sheet is in the

central part of the Territory, and the area is almost entirely mountainous or composed of high plateaux.

Colorado has one sheet, Greeley, on a scale of 1:125,000 and a contour interval of 20 feet. It is situated in the northern part of the State, on the plains, and is traversed by the South Platte River, flowing northward and eastward. Its valley is highly cultivated, and is intersected in every direction by irrigation ditches, and dotted with reservoirs.

Wyoming has two sheets, Aladdin and Fort McKinney, on a scale of 1:125,000, the former having a contour interval of 50 feet and the latter 100 feet. The Aladdin sheet, which lies in the eastern part of the State, bordering on South Dakota, mainly consists of plains and broken hills, rising in the western part of the sheet to mountains. The other sheet represents the eastern edge of the Bighorn Mountains, with the plains stretching eastward from their base.

In Utah there is one sheet, Coalville, on a scale of 1:125,000 and contour interval of 100 feet. This sheet is of special interest as representing the divide between the western end of the Uinta Mountains and the west flank of the Wasatch Range. It consists of a valley by the name of Rhodes, covered with gravel and small boulders, lying at an altitude of about 6,500 feet, above which the west end of the Uinta Range rises abruptly to an altitude of more than 10,000 feet. This region is drained by Weber River, flowing west out of the Uinta Mountains, and thence northward; while along the south edge of the sheet flows Provo River. The divide between the two streams is almost imperceptible, and suggests the possibility that the Upper Provo may formerly have flowed to the Weber.

Montana has two sheets, both on a scale of 1:125,000, with contour intervals of 100 feet. These sheets, Coopers Lake and Bonner, are in the western, mountainous portion of the State. Coopers Lake shows the main divide of the Mission Range, the mountains rising to altitudes exceeding 8,000 feet. Bonner sheet shows part of the drainage basin of Hell Gate River, immediately east of the City of Missoula.

Idaho has one sheet, known as Rathdrum, representing an area in the western part of the State, including most of Cœur d'Alene Lake and the southern part to Pend d'Oreille Lake. The central portion of the sheet is occupied by the Great Rathdrum prairie, evidently a basin, of which the two lakes mentioned, with numerous others, formed part, the whole being evidently of glacial origin.

In California are nine sheets, in the various parts of the State. They are upon various scales and various contour intervals. San Antonio and Rock Creek sheets represent the summit of the north slopes of San Gabriel Mountains, extending out into the Mojave desert on the north, and illustrate rather fine examples of alluvial cones. These sheets are on a scale of 1:62,500, with contour intervals of 50 feet. Santa Susana and Tejon are in the southern part of the State, and are largely comprised in the Pine Mountain and Zaca Lake Forest Reserve. Their scales are: the former 1:62,500, with contour interval of 50 feet, and the latter 1:125,000, with contour interval of 100 feet. These represent the coast ridges running rudely parallel to the coast of the west, intersected by broad valleys. The Calabasas sheet, on a scale of 1:62,500, with contour interval of 50 feet, stretches northward to the coast and directly west to Santa Monica, and represents the Santa Monica Mountains. Fernando and Corona sheets, also on a scale of 1:62,500, with contour interval of 100 feet, represent considerable areas in Southern California bordering the coast, including many towns and much rich agricultural land. The Santa Cruz sheet, on a scale of 1:125,000, with contour interval of 100 feet, shows the coast ranges from Santa Cruz to the foot of San Francisco Bay, and a part of the Santa Clara Valley. Fairoaks sheet, on a scale of 1:62,500, and contour interval of 10 feet, represents Sacramento, with the foothills of the Sierra Nevada to the east. The Randsburg sheet, on a scale of 1:62,500, with contour intervals of 50 feet, represents country about the mining camps of Randsburg and Johannesburg, in the southern desert part of the State. The topography consists of irregular mountain masses with broad desert valleys.

Besides the above sheets, the office has published special maps of mining regions. Among them are Banner Hill, in California; Encampment, in Wyoming; Park City, Utah; Terlingua, in western Texas, and Cœur d'Alene, in Idaho and Montana.

NEW MAPS.

NORTH AMERICA.

UNITED STATES.—(1) Map of the State of New York. Scale, 12 miles to an inch, showing the location of bluestone quarries. (2) Sheet of the State Topographic Survey, embracing the eastern Catskills. Scale, 1 : 62,500, or 9 statute miles to an inch, showing the location of bluestone quarries, in operation or not worked, together with the ledges of bluestone that have been opened for some distance. 1901.

These maps accompany *Bulletin* 281 of the University of the State of New York, in which the quarries of bluestone and other sandstone in the Upper Devonian of New York State are described. The name bluestone is commercially applied to the even-bedded and compact sandstone suitable for flagging and house trimmings found west of the Hudson River in southwest Albany County, and stretching southward through Greene, Ulster, Sullivan, and Delaware Counties, and as far west as Broome County, with scattered quarries still farther west. The district including Greene, Ulster, Delaware, Sullivan, and Broome Counties is most productive.

UNITED STATES.—Map of the San Juan Watershed, showing the location of Prehistoric Ruins. Scale, about 12 miles to an inch. Compiled by T. Mitchell Prudden. The New Era Printing Co., Lancaster, Pa. 1903.

This sketch map illustrates a paper on "The Prehistoric Ruins of the San Juan Watershed in Utah, Arizona, Colorado, and New Mexico," by Mr. Prudden, which recently appeared in the *American Anthropologist*, and is now reprinted. The map shows in red the situation of the numerous large pueblos, open ruins, and cliff houses that are widely scattered along the waterways of this drainage basin.

UNITED STATES.—Official Railroad Map of Kansas. Scale, 14 miles to an inch. State Board of Railroad Commissioners, Topeka, 1902.

The route of each of the railroads in the State is shown by a distinct colour, and the express companies operating over the several lines are indicated. Most of the place names, including all the railroad stations, are given.

UNITED STATES.—Department of Alaska. Scale, 50 miles to an inch. Compiled in the Engineer office of the Department of the Columbia and published by the Military Information Division of the War Department, 1902.

This small-scale map is based upon the surveys of the Coast and Geodetic and the Geological Surveys and those of the military expeditions under command of Glenn, Abercrombie, McManus, and Erickson. It should be useful to travellers and map compilers, as well as to the military service, as specially indicating railroads, wagon roads, trails, telegraph lines, post offices, and lighthouses. The forts occupied on Sept. 1, 1902, are shown.

UNITED STATES.—California. Scale, 26 statute miles to an inch. Southern Pacific Railroad Co.

This is a folder map with an index by which any place-name may readily be found. Letterpress covering the back of the map gives much condensed and recent information with regard to the geographic resources and industries of the State. It is one of the better kind of folder railroad maps, which would, however, give a more complete idea of the regions they depict if advantage were taken of the comparatively large

scale to indicate topography adequately, as is done in many similar publications of Germany.

UNITED STATES.—Map of the State of Washington, showing Classification of Lands. Scale, 6 miles to an inch. By Geo. H. Plummer, F. G. Plummer, and J. H. Rankine. United States Geological Survey, Washington, 1903.

This map accompanies Professional Paper No. 5 on "The Forests of Washington." It is printed in nine shades, which are used to show the distribution and value of the forests, such as the cut, timberless, and burned areas, and the estimated yield per acre of merchantable timber. The total amount of timber in the State under the Washington lumbering practice is estimated at 195,688 million feet B. M. Of this amount nearly 9-10ths, or 175,120 million feet, are west of the crest of the Cascade Range. The remainder, 20,568 million feet, is upon its eastern slope and in the northern and eastern parts of the State. West of the Cascade Range the country is heavily forested. East of it the land is mainly without timber.

UNITED STATES.—Map of the State of Oregon, showing the Classification of Lands and Forests. Scale, 12 miles to an inch. Prepared by Gilbert Thompson from information obtained by A. J. Johnson, United States Geological Survey, Washington, 1903.

The map accompanies Professional Paper No. 4 on "The Forests of Oregon." The information it presents is similar to that in the map of Washington above mentioned. The northern limit of red wood is in the extreme southwestern corner of the State. The burnt areas are shown to be very extensive, and are largest and most frequent in the western and more heavily-timbered part of the State.

CANADA.—(1) Assiniboia. Scale, 1:792,000, or 12.5 statute miles to an inch. By James White, Geographer of the Department of the Interior, Canada, 1903.

(2) Saskatchewan. Of the same scale, origin and date.

These maps show the extent of the Land Office surveys. Nearly the whole of the public area in Assiniboia has been plotted, and the survey is far advanced in the south central part of Saskatchewan and along most of the course of the North Saskatchewan River. The boundaries of the land districts and the location of the land offices are indicated in red. The Saskatchewan sheet is especially interesting because it is one of the regions which are now attracting many immigrants into Canada. The projected extension of the Canadian Pacific and Canadian Northern Railroads to meet the needs of this new region now opened for settlement are shown. Both railroad companies will construct branches to Prince Albert on the North Saskatchewan; and other extensions further west will traverse the valley of that river for a long distance.

CANADA.—Northern part of the Dominion of Canada. Scale, 1:3,500,000, or 55.23 statute miles to an inch. The *Geographical Journal*, London, August, 1903.

Illustrating the Journey of David T. Hanbury in 1901–1902 from Great Slave Lake down the Ark-i-Linik tributary of the Dubawnt River and across the Barren Lands to the Arctic Ocean. The nature of the country along the route north and also between Coronation Gulf and Great Bear Lake and the Eskimo camps along the Arctic coast is indicated.

SOUTH AMERICA.

BRAZIL.—Topographic map of the State of São Paulo, Brazil. Orville A. Derby, chief, and H. E. Williams, topographer. 1902 (Preliminary Edition).

In the past three years eleven folios of this map have been completed, and are most welcome, as evidence that the scientific mapping of Brazil is making some

progress. The folios are on a scale of 1:100,000, or 1.5 statute miles to an inch, each folio including an area embraced within 30′ of latitude and longitude. The contour intervals are 25 metres. The drainage is in blue, and wagon, railroad settlements, and other cultural features in black. The maps, produced at São Paulo, are very creditable.

NICARAGUA.—Scale, 1:792,000, or 12.5 miles to an inch. Prepared from official and other sources in the International Bureau of American Republics, Washington, 1903.

Shows the limits of steamer or canal navigation on many of the rivers, the location of gold and silver mines, the chief roads and stage lines, and considerable other information not seen on many atlas sheets. The boundary between Nicaragua and Costa Rica is delineated as finally agreed upon by the two countries.

EUROPE.

GERMANY.—Die Bevölkerungs-Dichtigkeit nach dem Ergebnis der Volkszählung vom 1 Dezember, 1900. *Statistisches Jahrbuch* für das Deutsche Reich. 1903. Berlin.

A map in 10 tints, representing the varying degrees of density of population in Germany according to the census of 1900.

GERMANY.—Die evangelische und katholische Bevölkerung im Deutschen Reich am 1 Dezember, 1900.

Shades of green show the areas in which Catholics and blue those in which Protestants predominated in Germany on December 1, 1900; the tints also showing the percentages of Protestants in the total Protestant and Catholic population.

GERMANY.—Die Forsten und Holzungen im Jahre 1900. Scale, 1:5,000,000, or 78.9 statute miles to an inch. Imperial Statistical Office. Vierteljahrshefte zur Statistik des Deutschen Reichs. Ergänzungsheft zu 1903, II. Berlin.

Three maps showing (1) the proportion of the entire area in each German State under forest; (2) the percentage of the forest area in each State covered with deciduous trees; and (3) the percentage of the forest area in each State covered with conifers.

SCOTLAND.—Bathymetrical Survey of the Fresh-water Lochs of Scotland. Scale, 1:21,120, or 1 mile to 3 inches. By Sir John Murray and others. The *Geographical Journal* and the *Scottish Geographical Magazine*, London and Edinburgh, September, 1903.

These maps, devoted to the lochs of Tay basin, are a part of the results of the bathymetrical survey of the fresh-water lochs of Scotland, which is now being carried out under the direction of Sir John Murray and Mr. Lawrence Pullar. Thirteen lochs are shown on the eight map plates, including Lochs Rannoch and Earn, which are among the larger and more important lochs of the Tay basin. The contours of the lake bottoms, shown in colours, were ascertained by 2,743 soundings, the average number of soundings per square mile of water surface being 180. The contours of the surrounding land surface are reduced from the 6-inch Ordnance Survey Charts. The cartographic results of these water and land surveys have been finely reproduced by Bartholomew on these map sheets. Longitudinal and cross sections of the depths are drawn for each loch.

NORWAY.—Geologic Map of Bergen and its Environs. Scale, 1:25,000, or 0.39 mile to an inch. By Hans Reusch. *Aarbog* of the Bergen Museum, No. 3, 1903. Bergen.

Illustrating a paper by Mr. Reusch on the geology of the city and its neighborhood.

AFRICA.

GERMAN EAST AFRICA.—Übersicht der geologischen Ergebnisse der Reisen der Berg-assessoren Bornhardt und Dantz, 1895–1900. Scale, 1:2,000,000, or 31.5 statute miles to an inch. Mitteilungen von Forschungsreisenden und Gelehrten aus den Deutschen Schutzgebieten, Vol. XVI, No. 2. 1903.

Sixteen colours are used to show the surface geology of German East Africa as far as observed during the extensive journeys of Messrs. Bornhardt and Dantz in most parts of the country. A large amount of geographical information also given is very clearly shown.

EAST AFRICA.—Grenzen in Ostafrika. Scale, 1:12,000,000, or 189.3 miles to an inch. *Deutsche Rundschau für Geographie und Statistik*, Vol. XXV, No. 10. 1903. Vienna.

Showing the boundaries between Abyssinia and the surrounding possessions of Great Britain, Italy, and France according to treaties concluded from 1900 to 1902.

LAKE CHAD.—Territoire Militaire du Tchad. By Captain Bézu. Scale, 1:2,500,000, or 39.4 statute miles to an inch. *Revue de Géographie*. July, 1903. Paris.

A sketch map of the region of Lake Chad and the Shari river, showing the itineraries of the French troops and exploring detachments in 1900–02 between the north side of Lake Chad and the Mobangi tributary of the Congo. These routes are numerous, covering a large area of new territory, and are dotted with many scores of new settlements not hitherto indicated on maps. The map will be useful as showing at a glance the routes of the French expeditions, whose new contributions to the geography of inner Africa are to be published in a series of monographs.

RHODESIA.—Southern Rhodesia. A map showing the gold Districts of Mashonaland and Matabeleland. Scale, 65 statute miles to an inch. *Reports* on the Administration of Rhodesia, 1900–1902, British South Africa Co.

Mining districts, chief mines and railroads completed, building or projected, are shown.

RHODESIA.—Southern Rhodesia. A map to illustrate the Rhodesia railroad system. Scale, 80 statute miles to an inch. *Reports* on the Administration of Rhodesia, 1900–1902, British South Africa Co.

Shows all stations along the railroad line; also telegraph and telephone lines.

RHODESIA.—North Eastern Rhodesia. Scale, 65 miles to an inch. *Reports* on the Administration of Rhodesia, 1900–1902, British South Africa Co.

This map, accompanying the report on Northeastern Rhodesia, shows administrative division, telegraph and post offices, roads and places where a judicial officer resides. The boundaries and positions of places are only approximately correct.

ASIA.

CHINA.—South Western China. Scale, 1:2,000,000, or 31.56 statute miles to an inch. The *Geographical Journal*, London, August, 1903.

This map, illustrating a paper by Capt. C. H. D. Ryder, R.E., showing the Chinese province of Yunnan and the surrounding regions, was reduced from 34 sheets of the frontier surveys now being published under the direction of the Surveyor-General of India, on a scale of 4 miles to an inch. This material was supplemented in parts by the route surveys of various explorers. The map contains a far larger number of place-names in this still inadequately-explored region than any earlier publication.

COREA.—Geotectonic Map of Korea. Scale, 1 : 2,000,000, or 31.5 statute miles to an inch. Compiled and transliterated by B. Kotô, Ph.D., *Journal* of the College of Science, Imperial University, vol. xix, Tokyo, 1903.

Giving the geologic, structural lines—lines of dislocation and folding.

ATLASES.

STIELER'S HAND-ATLAS.—Neue, neunte Lieferungs-Ausgabe. 100 Karten in Kupferstich. 17 und 18 Lieferungen. Gotha, Justus Perthes. Price, 60 pf. for each part, containing 2 map sheets.

This double part contains 4 sheets. Nos. 17 and 18 are revisions of plates 1 and 2 of Vogel's map in 4 sheets of Austria-Hungary, on a scale of 1 : 1,500,000, or 23.67 statute miles to an inch. Their beauty and legibility are increased by the new process of production. The mountain features are more sharply defined by the greater contrasts between light and shade. No. 38 is the new plate of the southern part of Great Britain, on a scale of 1 : 1,500,000, in which, without sacrificing clearness of topographic delineation, the place-names are at least four or five times as numerous as in the earlier map. The nomenclature is in English, while the map it replaces had many German spellings, as "St. Georges Canal" and "Irische See." No. 58 is also a new map, giving East Siberia and Manchuria, by Habenicht. The scale, 1 : 7,500,000, or 118.3 statute miles to an inch, is nearly three times as large as that on which this territory has been presented in earlier editions of this atlas. The result is that the map gives an unequalled idea of the geography of East Siberia. This sheet completes the two-sheet map of Siberia in the new edition of this atlas.

Atlas Colonial Português. Ministerio da Marinha e Ultramar. Lisbon, 1903.

Though these 11 sheets, in colours, are not of a high order of cartographic excellence, the scale, in some instances, is large, so that more detail is given than in many good atlases.

M. FROIDEVAUX'S PARIS LETTER.

PARIS, Sept. 16, 1903.

The first meeting of the Committee appointed by the Seventh International Geographical Congress at Berlin, in 1899, to consider a scheme of sub-oceanic terminology may find a place here, though held at Wiesbaden. M. Julien Thoulet made a report on the subject of a map of the ocean depths, and the Prince of Monaco, who presided, announced that he assumed the cost of this map, which is to be brought out, with the collaboration of the hydrographic services of the world, by the Oceanographical Museum of Monaco. The map will be on a scale of 1:10,000,000, on Mercator's projection from 72° south to 72° north, and on the gnomonic projection for the polar ice-caps. The plan of the map is to be submitted to

the Eighth International Geographical Congress at Washington, in 1904.*

The twenty-fourth session of the Congress of French Geographical Societies was held at Rouen, in August, under the auspices of the Norman Geographical Society. Besides papers on subjects of general geography there were many studies of Normandy, and especially of its coasts. The meetings were well attended, and the session was closed by an excursion to London, where the visitors enjoyed the hospitality of the Royal Geographical Society.

The French Association for the Advancement of Science met at Angers, also in August. In the Geographical Section communications to be noted were those of M. Jean Brunhes (On Irrigation in Moist Countries, with the Limousin as type of a Moist Temperate Region and Java as type of a Moist Tropical Region), of Dr. Dufour (On Bee-Culture in France), and Dr. Raulin (On the Forests of Southern Madagascar). Attention may be called to Prof. Bigot's paper on the Drying-up of Valleys in Calvados, and to that of MM. Bernard Brunhes and David on the curious Magnetic Anomaly between the eastern and the western slopes of the Puy-de-Dôme.

Very interesting was a discussion of several memoirs on the subject of whirlpools and cyclonic movements. M. Jean Brunhes analysed the studies of three writers (MM. Emile Chaix, Squinabol, and Dal Piaz) on the *oules* † of the Valserine, the *chaudrons* † of the Brenton, the *Marmites* † of the Mas, etc., and explained his own researches on the work of whirlpools in the erosion of valleys. M. Bernard Brunhes thought it possible to find a connection between the rotation of the earth and the predominance of whirlpools moving directly, like whirlwinds, and perhaps a confirmation of the celebrated law of De Baer on the deviation of water-courses towards the right. M. Fabre spoke on the dissymmetry of river valleys, and M. Bruyant on the *seiches* of Lake Pavin and his verification of Forel's formula, made for the first time on a lake in the central *massif* of France.

An interesting experiment made by M. Louis Olivier, of the *Revue Générale des Sciences*, is to be recorded. He is organizing cruises, or excursions, of commercial reconnaissance, the first of which is to visit, in the month Oct. 13–Nov. 17, the principal ports of the eastern Mediterranean. Lectures will be given by specialists on the economy, the riches, the resources, and the tariffs of the

* It is announced that work on the map is begun, and will be carried on without waiting for the meeting of the Congress.

† Local names for the cavities known as pot-holes or giants-kettles.

countries visited, the habits and commercial usages and the wants of the inhabitants, and the passengers will have an opportunity of visiting at each seaport the establishments which particularly interest them.

In the last report of the Paris Observatory there is much to reward geographers, as well as other students. It is especially gratifying to note that the co-operation of the two observatories, Paris and Greenwich, has determined with absolute precision the difference of longitude between the two meridians within the hundredth part of a second of time.

With the degree of our acquaintance with countries varies the study devoted to them. M. Henri Bresson offers an illustration of this fact in undertaking to determine, for that part of Western France known as the Norman Switzerland,* the geographical distribution of the hydraulic forces; or, as he expresses it, the *green coal.* The *white coal* of our mountains takes its name from the glaciers; the *green coal* is the name given by M. Bresson to the water which comes from the grassy plateaux, the elevated meadows, and the forests. His painstaking studies of this extensive region have enabled M. Bresson to produce very valuable maps of the water resources of nearly all Norman Switzerland.

Exploration is active in Africa. Dr. Maclaud, of the Franco-Portuguese Commission, is at work upon a map of the frontier on a scale of 1:100,000.

Capt. Lenfant, the explorer of the Niger, is now at the head of an expedition organized by the Geographical Society, the Academy of Inscriptions and Belles-Lettres, and the Ministry of the Colonies. He is to ascend the Forcados to the Niger, then to enter the Benue and reach the Tuburi swamp and the Logone, and, finally, Lake Chad. This important expedition will have for a practical result the survey of a water-route uniting Lake Chad with the Atlantic. Capt. Lenfant reached Lokodja, at the confluence of the Niger and the Benue, on the 11th of August. He expected to be at Garossa on the 23d, and he hoped (if navigable channels really exist between the Benue and the affluents of the Chad) to arrive at the lake about the 15th of September, or in sixty days after leaving Paris. This would be a result of the greatest economical importance; for the ton of merchandise would cost for its transport from Bordeaux to Lake Chad only 450 francs, while by way of the Congo it now costs 2,250 francs.

* Including the Departments of Calvados, Orne, Eure, Eure-et-Loir, Sarthe, Mayenne, and, in part, of Maine-et-Loire and Manche.

M. Perdrizet has just completed his reconnaissances and passed from the Ubangi to the Shari by the Fafa (previously unexplored in its middle and upper course) and the Bahr Sara; and he has made a survey of his route on a scale of 1:50,000.

In Eastern Africa M. Alluaud will study the geology and natural history of the country between Mombasa and the Victoria Nyanza and Mount Kilimanjaro.

In Asia Lieut. Grillères has undertaken an exploration of the bend of the Yang-tsze, made more difficult for a time by the troubles in Yunnan. He proposed to travel on foot and to continue his journey to the west and make an attempt to enter Tibet.

M. Giraud is engaged in Martinique in the study of the Montagne Pelée and the changes of the shores.

Mention must be made of Dr. Charcot's departure for the Antarctic, accompanied by M. de Gerlache and a number of specialists.

Among recent geographical publications attention must be called to one by M. Jean Brunhes, printed in the *Memorie della Pontificia Accademia dei Nuovi Lincei.* This is a study on the work of whirlwinds in rock sculpture, and the author's conclusion is that *revolving winds constitute the most active and the most irresistible form of attack in the great operation which everywhere and incessantly tends to level the continental relief.*

Two works calling for more extended notice are the *Architecture of the Soil of France*, by Commandant O. Barré, and the *Geographical Picture of France*, by M. P. Vidal de la Blache.

A volume on Savoy, by MM. Révil and Corcelle, in the series of "Guides du Touriste, du Naturaliste et de l'Archéologue," is a good book, and with it may be consulted the memoir brought out in 1752 by the Marquis de Paulmy and lately republished by M. Henri Duhamel under the title of "A Journey of Inspection of the Alpine Frontier."

Not to be overlooked is the remarkable note contributed to *La Géographie* for July by M. Squinabol, of Padua, recording his observations on the insecure ground of Capracotta, in Molise; and M. Martel's article in *Spelunca* On the Caverns of Majorca will repay study.

As usual, there is much written about Africa. M. de Lapparent considers in *La Géographie* for June the evidences of a Marine Formation of the Tertiary Age in the French Sudan. His conclusions, drawn from Col. Monteil's discovery of a fossil sea-urchin at Bilma, have been confirmed by the later discoveries of Capt. Gaden in a

dallol * at Tamaské (a military territory between the Niger and the Chad) and those of other observers in the wells of Baol near Dakar.

M. de Lapparent finds that at the time when the Lutetian Sea covered the region of Paris, North Africa formed an island comprising the elevated masses of the Aïr, the Tassili, the Ahaggar, and the Tuat, and bathed on the south by an arm of the sea coming from the Atlantic and passing by Senegambia, and on the east by the sea of Bilma. Beyond this sea rose the island, or the peninsula, of Ethiopia; and still to the eastward of this another sea, the traces of which are found in Somaliland, on the coasts of East Africa, and in Madagascar.

Capt. Lenfant's book on the Niger† is to be read with his very full Report, published in the *Bulletin de Géographie Historique et Descriptive* (No. 1, 1903).

Very full of interest is M. Superville's account (in *La Géographie* for July) of his journey between the Ubangi and N' Delle, by the Kotto River, with its map on a scale of 1:1,000,000.

These are but a few of the original papers which within the last few months have added to our knowledge of African geography.

In closing this letter I may call attention to two works of great merit—Dr. Verneau's book on the Ancient Patagonians and M. Marcel Dubois's *Géographie Générale*.

HENRI FROIDEVAUX.

The Geographical Journal for August prints (pp. 192–194) the terminology of the most important forms of sub-oceanic relief, proposed at the Wiesbaden meeting by Prof. Supan, with the English equivalents suggested by Dr. H. R. Mill, and the French by Prof. Thoulet.

The opinion of geographers is asked as to the appropriateness of this terminology (here somewhat condensed) or as to the best synonyms of the German terms.

I. THE GREATER FORMS.

1. The *Shelf* (Ger. *Schelf;* Fr. *Socle* or *Plateau continental*). This is the portion of the continental border which extends seaward from tide-marks, sinking gradually to the depth of about 100 fathoms and then suddenly falling steeply to a great depth.

Examples: The British, Sunda, and Newfoundland shelves.

2. The *Depression* (Ger. *Vertiefung*) is enclosed on all sides by elevations of the sea-bed.

(*a*) The *Basin* (Ger. *Becken;* Fr. *Bassin*) is a depression of approximately round form.

(*b*) The *Trough* (Ger. *Mulde;* Fr. *Vallée*), an elongated and wide depression, with gently-sloping borders. A trough may be divided by transverse elevations into basins.

* The *dallol* is a native name for *ravine*, or *dry river-bed*.

† Le Niger Voie ouverte à Notre Empire Africain.

(*c*) The *Trench* (Ger. *Graben;* Fr. *Ravin*) is also an elongated but proportionally narrow depression, with steeply-sloping borders, one of which (the continental) rises higher than the other (the oceanic). Trenches are the ends of unsymmetrical basins, and lie beside the continental border or island chains. The Cayman trench (in the Caribbean) alone runs between islands, but in its case also the borders are of unequal height. Strictly speaking, the trench is only a secondary form of the great depressions of the ocean floor, but, on account of its length, depth, and genetic importance, it may be reckoned one of the principal forms.

The extension of a trough or basin which penetrates the land or a submarine elevation either with a uniform or a gradually-diminishing depth, or which is bounded on the one side by land and on the other by a submarine elevation, may be—

(*a*) An *Embayment* (Ger. *Bucht;* Fr. *Golfe*), if wide, and of a rounded or triangular form, as, for example, the East Australian embayment.

(*b*) A *Gully* (Ger. *Rinne;* Fr. *Chenal*), if long and narrow (*e. g.*, the Faroe gully, the Norwegian gully).

3. The *Elevation* (Ger. *Erhebung*) is either entirely surrounded by depressions or is a prolongation of the continental border.

(*a*) The *Rise* (Ger. *Schwelle;* Fr. *Seuil*) is an elevation which rises gradually with an angle of only a few minutes of arc, irrespective of whether it is wide or narrow, or of its vertical development. Rises carry the chief features of suboceanic relief, so that if the ocean floor changed into dry land they would act as the main watersheds.

(*b*) The *Ridge* (Ger. *Rücken;* Fr. *Crête*) is a relatively narrow elevation, which rises at a steep angle. It is narrower than an extended rise, the distinction being clear where a rise assumes in parts the character of a ridge, as, for example, the Atlantic equatorial ridge.

(*c*) The *Plateau* (Ger. and Fr. *Plateau*) is a steep elevation of large extent, in which the length and breadth do not greatly differ.

It may rise from the depressions of the ocean floor, or form a rise (*e. g.*, the Azores Plateau).

4. A *Deep* (Ger. *Tief;* Fr. *Fosse*) is the deepest part of a depression (*e. g.*, the Nero Deep).

A *Height* (Ger. *Höh;* Fr. *Haut*) is similarly the highest part of a rise, ridge or plateau, if it does not belong to the base of an island or is classed as an independent minor form.

II. Minor Forms which are of smaller extent, but on account of steeper slopes clearly distinguished from their surroundings, include—

1. Elevations:

(*a*) Elongated elevations usually of irregular surface: Ridges.

(*b*) Single elevations or submarine mountains, particularly—

(α) The *Dome* (Ger. *Kuppe;* Fr. *Dôme*), an elevation of small area, but rising with a steep angle to a depth of more than 200 metres from the surface.

(β) The *Bank* (Ger. *Bank;* Fr. *Banc*), rising to within 200 metres of the surface, but not so far as within 11 metres.

(γ) The *Shoal* (Ger. *Grund;* Fr. *Hautfond*) and *Reef* (Ger. *Riff;* Fr. *Récif*), which come within 11 metres of the surface and are dangerous to shipping.

2. Depressions:

(*a*) The *Caldron* (Ger. *Kessel;* Fr. *Caldeira**), a more or less steep depression of relatively small extent.

(*b*) The *Furrow* (Ger. *Furche;* Fr. *Sillon*), a valley or channel-like hollow in the continental border, and more or less at right angles to it.

* It is not explained why this Portuguese word is offered as French.

LATITUDE AND LONGITUDE OF CHENGTU-FU.

CHENTU, CHINA, 8/22/1903.

Editor American Geographical Society Bulletin,
New York.

DEAR SIR:

As Chentu is one of the Provincial capitals of China, and a city of possibly 500,000 inhabitants and a centre toward which both miners and traders are looking, it is possible that the data, so far as known, for its location would be acceptable to your paper.

Latitude determined from about 20 observations of stars on Meridian, both North and South, Methodist Episcopal Mission compound = L. 30° 39′ 19″ N.

Longitude determined by moon culminations, with transit theodolite—14 sets during August, 1903, place same as latitude. λ—6h. 57m. 28s. East from Greenwich (Long. 104° 22′ East).

Magnetic variation = 5′ west determined with theodolite.

Should I get different determination for longitude I will advise you.

Yours truly,

J. F. PEAT,
Missionary, M. E. Church.

According to Longman's Gazetteer, Chengtu-fu is in N. Lat. 30° 45′, Long. 104° 10′ E. Vivien de Saint-Martin's *Nouveau Dictionnaire* places the city in 30° 40′ 41″ Lat. N. and Long. 101° 50′ 30″ E. from Paris = 104° 10′ 44″ E. from Greenwich.

BOOK NOTICES.

The two volumes which contain the account of the Duke of the *Abruzzi's attempt upon the North Pole are, to me, the most interesting and attractive of any of the recent Arctic narratives.

From the second paragraph of the introduction—

> The practical use of Polar expeditions has often been discussed. If only the moral advantage to be derived from these expeditions be considered, I believe that it would suffice to compensate for the sacrifices they demand. As men who surmount difficulties in their daily struggles feel themselves strengthened for an encounter with still greater difficulties, so should also a nation feel itself still more encouraged and urged by the success won by its sons to persevere in striving for its greatness and prosperity—

to the last sentence of the Duke's dispatch to King Victor Emmanuel—

> The steadfast courage and determination manifested by the leader of the sledge expedition and by all those who composed it, in spite of immense hardships, assured its success, and acquired fresh glory for our country, by making its flag wave at the highest latitude which has hitherto been reached—

the narrative breathes the spirit of modest determination and effective self-reliance.

Though not as widely heralded either before, during, or after as the expedition of his predecessor Nansen, Abruzzi's expedition was a striking success. The very quietness, effectiveness, and celerity with which his work was accomplished militated against its attracting as much attention as Nansen's protracted voyage. The world did not have time to get uneasy or curious in regard to Abruzzi before he was back again with his work accomplished.

He was fortunate in forcing his ship quickly, and with comparative ease, beyond the northern extremity of Franz Josef Land—a feat not accomplished by any of his predecessors in that region.

The mishap to his ship, following almost immediately after, leaving her forced against the shore and, as it was thought, rendered unseaworthy, only served to bring out strongly the courage and resourcefulness of Abruzzi and his companions.

The successful northing attained by the ship was fittingly

* On the "Polar Star" in the Arctic Sea. By His Royal Highness Luigi Amedeo of Savoy, Duke of the Abruzzi. With the Statements of Commander U. Cagni upon the Sledge Expedition to 86° 34′ North, and of Dr. A. Cavalli Molinelli upon his return to the Bay of Teplitz. Translated by William Le Queux. In two volumes, with 212 illustrations in the text, 16 full-page photogravure plates, 2 panoramas, and 5 maps. 8vo. London, Hutchinson & Co., 1903.

capped by the bravery of Cagni and his men in making their departure from the land in the following spring in spite of the most trying obstacles of open water, young ice, and the moving pack, and by their dogged persistency in pushing their way to the highest latitude yet attained in the central polar basin.

It must have been a source of the liveliest regret to Abruzzi—a regret which is shared by the writer—that an accident to himself in a preliminary sledge trip prevented him from commanding this northern party.

On the other hand, it is a source of the most intense satisfaction, for the sake of the men themselves, of Abruzzi, and of the cause of Arctic Exploration in general, that the loss of Cagni's party—a loss which would have made the Expedition a complete catastrophe, instead of a splendid success—was averted, though literally almost by a hair's breadth.

The observations and results of the expedition are valuable.

Cagni's journey straight away north, 326 miles as the crow flies, from C. Fligely, dissipated completely the penumbra of uncertain islands which has surrounded Franz-Josef-Land since Payer and Weyprecht's visit, and defines the group sharply and clearly as an archipelago of moderate size, its northern shores lying third in order of proximity to the Pole.

The expedition was particularly valuable, in my opinion, in that it eliminated from further consideration the so-called Franz-Josef-Land route to the Pole.

It is interesting to note that of the various explorers of Franz-Josef-Land, viz.: Payer and Weyprecht, Leigh Smith, Jackson, Wellman, Baldwin, and Abruzzi, the last is the only one who succeeded in pushing beyond the northern headland of the archipelago.

In view of this fact Abruzzi's remarks upon the subject of the attainment of the Pole are particularly valuable as well as extremely interesting. His words are given in full:

> It would be useless to repeat the attempt [of reaching the Pole] by following the same plan [the route from Franz-Josef-Land]. It would, at most, be possible to push a few miles further towards the north, if the ice on the Arctic Ocean was in an unusually favourable state; but the results would not afford any compensation for the fatigue and the privations undergone. While following, therefore, the invariable plan of setting out from some point on land, and not from a ship drifting in the ice, on account of the reasons put forth in the first chapter of this work, it will be necessary to find some other method of shortening the distance which has to be travelled with sledges. What I should recommend would be to sail along the western coast of Greenland to the north of Kennedy Sound, where it ought to be possible, under favourable conditions, to go to a still higher latitude than that reached by the *Alert* off Grant Land. * * *

The weight of the load carried by the sledges should not be calculated according to what the men and dogs can draw, but according to the limitations imposed by the unevenness of the ground over which the march must be performed. On ice in the neighbourhood of land, the weight of the load, together with that of the sledge, must not be over 550 lbs. * * *

It should be remembered that, no matter from where the start may take place, there will always be a belt of very difficult ice in the vicinity of land. * * *

This belt of rugged ice, as was observed when Cagni's expedition set out, may be looked upon as extending about 120 miles from the coast. * * *

Greenland possesses the following advantages over Emperor Franz Josef Archipelago. The funnel formed by the northern opening of Robeson Sound and Grant Land to the west, and Greenland to the east, must stop the movement of the ice towards the south in spring, when the expedition would be on its way towards the north, and would thus prevent the drift which reduced the length of Cagni's daily marches so much, especially during the period of the expedition.

Emperor Franz Josef Archipelago forms a triangle, with its summit towards the north, and is, therefore, difficult to find; and what happened to Cagni * * * might happen to any detachment that wanted to reach the camp on Prince Rudolph Island. This danger does not exist in Greenland, * * * and if the expedition deviated from its course when returning, it would easily find the camp by following the coast."

Abruzzi has arrived independently, completely, and clearly at my own views. I regret that he could not have combined with his intelligent preparation and courageous push my own years of experience in equipment, icecraft, and management of dogs. Could this combination have been possible, while Abruzzi would not have reached the Pole he could have increased his already splendid march by at least a hundred miles.

There is another aspect of Abruzzi's expedition which is instructive—the example which he has given to young men of wealth and leisure all over the world to devote their time and their money to adding something to the store of the world's knowledge and attaining for themselves an honorable and commanding reputation, rather than waste both time and money in pursuit of amusement, or worse.

Altogether, Abruzzi himself, and his expedition, possess a striking personality. The expedition will last long in the annals of Arctic effort, and the Duke has proved himself well worthy of the traditions of the House of Savoy.

The style of the narrative is effective—it is simple, modest, clear, and direct. There is no padding; there is no space wasted in communing with the infinite, or in word-painting. Finally, Abruzzi has been fortunate in his translator, and the book is almost entirely free of the peculiarities which often unfavorably impress one in reading books translated from a foreign language.

R. E. Peary.

Central Europe. By Joseph Partsch, Ph.D., Professor of Geography in the University of Breslau. With Maps and Diagrams. In The Regions of the World Series. Edited by H. J. Mackinder, M.A. D. Appleton & Company, New York, 1903.

Professor Partsch's contribution to this series is a very interesting volume. The territory he describes extends from the North and Baltic Seas to Turkey, or, in other words, it embraces Belgium, the Netherlands, and Germany in the north, Switzerland and Austria-Hungary in the centre, and Montenegro, Servia, Rumania, and Bulgaria in the south. Over this very large region he travels again and again, describing it in its various aspects. To profit most by its perusal the reader should follow the text with a good atlas. The considerable number of small maps scattered through the book are very useful for their special purposes; but few books have recently appeared which will so well repay careful reading with a first-rate atlas at hand. Such a book as this and good maps for constant reference help one another. Both are illuminative; and each aids the other to impart to the mental vision a clear and accurate view of the things described and their relations. The book may well be recommended to any mature student to be read in this way, securing at once a fine, thorough, geographic study and excellent drill in map reading.

The first seven chapters are given to a concise treatment of the physical history and present physical condition of Central Europe, interesting because the author has imagination as well as scholarly attainments, and all the more interesting if read, or rather studied, with much care; for work of this sort may not prove to be remarkably edifying to those who do not understand each statement both in itself and also in its relation to the context. The essentially continental climate is depicted in its normal conditions, its sharp contrasts, and its striking departures from the normal, as exhibited in Herzegovina. The great movements and migrations of the peoples which may be traced with certainty only for twenty centuries are described. Only one chapter is given to the political development of these States, and thus little more than a general glance at their conformation is possible.

Forty-two pages are devoted to the most striking facts of economic geography. This chapter exhibits strongly a noteworthy characteristic of the entire volume, or, in other words, a dominating feature of its plan, without which so much ground could scarcely be covered successfully in 358 pages. Minutiæ are rigorously repressed, and attention is centred upon the essential, vital features

of the topic. Thus the space given to cattle is less than two pages; but the part of cattle in the economy of Central Europe, the marked differences between these animals in the Baltic peninsula, on the North German plain, and among the central mountain pastures, with the differing purposes for which cattle are reared, are clearly brought out; and the effect of the sparsity or abundance of natural productions upon the trade relations with other lands is shown.

Chapters XII to XVIII inclusive are given to a more detailed treatment of the countries. The value of these chapters is heightened by the fact that the dominating note is the influence of the geographic environment upon the development and the material position of the various peoples. Cause and effect are everywhere closely united. The natural influences that have tended to turn the energies of the Swiss very largely into industrial channels, the water-power that gives its support to the cotton trade of Northeastern Switzerland, the topography which in that republic has nurtured the development of several independent and competing centres of intellectual and material exchange; the position of Budapest, close to the mountain regions whence come its wood and ores, its wines and building stone, and overlooking the immeasurable plains on the east, whose cereals, cattle, and horses are brought hither to market, all of which have fostered the blossoming of Budapest into one of the finest of modern cities, are examples of Dr. Partsch's able treatment of the anthropogeographic aspects of Central Europe. The volume is concluded with chapters on water and rail communication and conditions of national defence, followed by a copious index.

Each chapter in the book ends with a list of authorities in which those portions of their writings bearing especially upon the topic of the chapter are indicated. Dr. Partsch's manuscript was found to be too long for publication in an English series, and it was therefore abridged in the translation. It will be published in German in the original form.

A Guide to Belfast and the Counties of Down and Antrim. Prepared for the Meeting of the British Association by the Belfast Naturalists' Field Club. The Linenhall Press, Belfast, 1902.

Since 1874 specially-prepared guide books have usually been adjuncts of the Annual Meetings of the British Association. The topics in each hand-book are prepared by experts, and the result is a work that is very useful to the members of the Association and

also to the general public. The present hand-book describes and illustrates with many pictures the history, trade, agriculture, geology, botany, zoology, and archæology of Belfast and the adjoining counties. It will serve for years as a standard work of reference on the district. Three fine maps are included—a topographic and road map and geologic and archæologic maps.

Gazetteer of Upper Burma and the Shan States. In five volumes. Compiled from official papers by J. George Scott, F.R.G.S. Assisted by J. P. Hardiman. Printed by the Superintendent of Government Printing, Rangoon, 1900–1901.

The five volumes of this work contain more than 3,000 pages. Part I (2 volumes) is devoted to the geography, geology, history, religion, resources, and past and present systems of government. All information is given in great detail, from Burmese sources, in matters relating to the reigns of King Mindôn and King Thibaw, but chiefly from official reports, including those of members of the Geological Survey of India. The history supplied by Burmese writers is a curious document, giving little attention to events outside of the capital. It is worthy of preservation as showing the way in which the Burmese thought history should be recorded and for the light it throws upon the character and life of the last two kings of Upper Burma and the doings at their courts. Part II (3 volumes) is a Gazetteer of Upper Burma and the Shan States. It is reasonable to infer from the following typical paragraphs that no hamlet in the country has escaped mention:

HPA HSŌ.—A village in the Man Sang circle of the Northern Shan State of South Hsen Wi. It had in March, 1892, nine houses, with forty inhabitants. . . . The villagers cultivate lowland paddy.

KAK LŌN.—A Yang Lam village in the Man Hpai circle of the Northern Shan State of South Hsen Wi, situated in the rolling country west of the Loi Kawng peak. There were eight houses in March, 1892, with thirty-nine inhabitants, who cultivated hill-rice and cotton.

Important towns, rivers, mountains, etc., receive detailed treatment. Forty-three pages, for example, are given to Mandalay and the district around it. The Gazetteer contains a vast amount of information that cannot readily be obtained elsewhere, and this enhances its value as a reference book.

Le Japon, politique, économique et social. Par Henry Dumolard, pp. viii+342. Librairie Armand Colin, Paris, 1903.

During the three years Mr. Dumolard lived in Japan he had special advantages, both as Professor of French Law at the Uni-

versity of Tokio and as the head of the Commission sent to Japan by the French Ministry of Public Instruction, to become unusually well acquainted with the people and institutions of the country. His time was largely occupied with the study of the political, social, and economic conditions of Japan, and in this book he records the results of his observations. His aim was to picture the Japan of to-day, not in the superficial and minor aspects which are made so prominent in books of travel, but as a powerful empire, with an army, fleet, universities, parliament, politicians, and newspapers—a nation whose interests are closely identified with those of other countries. This volume is of the first importance in any study of Japan.

Report by His Majesty's Commissioner on the East Africa Protectorate, pp. 47. Eyre and Spottiswoode, London, 1903. Price 5d.

The British East African Protectorate lies between the Indian Ocean and Lakes Victoria and Rudolf, and between the Italian possessions and the Juby River on the north and German East Africa on the south. The seat of government is Mombasa, where the Commissioner resides. The large country is divided into seven provinces, over each of which is a sub-commissioner. The report of Commissioner Eliot contains a summary of the geography, resources, and native tribes of the Protectorate, the northwest part of which, however, is still almost unexplored; while studies of the other districts are still in progress. The Commissioner is convinced of the possibility of white colonization on the highlands or plateaux (6,000 to 8,000 feet above the sea) west of the Mau escarpment. He says the average mean temperature in this elevated region is 67° F. at 9 A.M. and 78° F. at noon; and the nights are much cooler. "Ten years' experience shows that the climate is healthy and invigorating, and that European children born in the country may live and thrive there." The Protectorate has abundant resources, and Mr. Eliot believes that tobacco and cotton especially may be cultivated on a large scale in the lowlands.

Deutschland im Stillen Ozean. By Dr. Georg Wegener. With 140 photographs and a Map in colors. Velhagen & Klasing. Bielefeld and Leipzig.

This handsome little volume is No. 15 in the *Land und Leute* series of geographical monographies. Dr. Wegener describes the Samoa, Caroline, Marshall, Ladrone and Salomo islands, Kaiser Wilhelm's Land and the Bismarck Archipelago, and his competency for the task is enhanced by the fact that in 1900 he visited all the

German possessions in the Pacific, excepting the Marshall and Salomo islands. He tells how these islands, widely scattered through Polynesia, Melanesia and Micronesia, came into the possession of Germany; describes their broader aspects in respect of geologic formation, climate, and plant and animal life, and then writes in considerable detail of each of the possessions. The descriptions are clear, comprehensive, and accurate, and lose no value from the fact that they were written for the general public. The photographs are interesting and instructive, the map is helpful, and the index renders it easy to use the work as a book of reference—and it is worthy of such use.

Yearbook of the United States Department of Agriculture, 1902. Washington, D. C., 1903.

The Bureau of Soils of the Agricultural Department has a force of over 100 men engaged in soil surveys in various parts of the country. Their work throws light upon the nature and distribution of our soils and their possibilities. The area surveyed and mapped in the fiscal year 1901–02 was 14,541 square miles, making a total up to that time of 22,623 square miles, or 14,478,720 acres. The soil maps covering this area are on a scale of 1 mile to an inch, and have been published or are ready for publication. The largest areas thus far covered by the soil surveys are: California, 2,154 square miles; Maryland, 2,180 square miles; North Carolina, 3,425 square miles; and Virginia, 1,604 square miles. The surveys are a valuable contribution to economic geography. As an example of their benefits, they have distinctly suggested, in Prince George, St. Mary, and Calvert counties, Md., the specialization of certain crops in the line of fruit-growing, trucking and general farming and dairying. The work of the Experiment Stations includes studies of climatic and weather conditions as related to plant growth; and the Department of Agriculture has introduced many new variations of crops, such as the Manshury barley, which has increased the yield of barley over a wide region; Kafir corn, introduced in 1886 as a crop for regions of scanty rainfall, the Kansas crop alone in 1899 being valued at over $6,000,000; macaroni wheats that bid fair to supply all our macaroni in a few years; Turkestan alfalfa, Sumatra tobacco, Egyptian cotton, and many other crops that are now successfully growing in this country.

Besides all the information which the *Year Book* brings annually to the farmers of this country it is a valuable source of reference for matters relating to economic and commercial geography.

Shell Heaps of the Lower Fraser River, British Columbia. By Harlan J. Smith. Vol. IV, Part IV, of Memoirs of the American Museum of Natural History. New York, March, 1902.

This memoir contains the results of Mr. Smith's exploration in 1897–98 of shell heaps along the lower Fraser River. These heaps, made up of layers of shell and other refuse from native villages, are the most extensive remains of the early inhabitants of the coast. They are found on many flats along the shore, and at the mouths of streams where the beach is smooth enough for canoe-landing. They are usually several hundred yards in length, about 30 yards wide, and 3 or 4 feet high; but some of them are miles in length, and some are 9 feet high, or more. Stumps of Douglas fir, 7 feet in diameter, standing on some of them, indicate that the top layer of these heaps is not less than 500 years old. Some skeletons and stone arrow-points, shell-beads and other objects are found in the heaps. The strata are often composed entirely of the remains of clams, mussels, oysters, and other shell fish. Vegetable mould and general refuse also make up a large part of some heaps. Mr. Smith's monogram is a description of the shell heaps, and the objects revealed by his excavations are illustrated by many woodcuts and a number of instructive photographs.

A Bibliography of Geodesy. (Second Edition.) By James Howard Gore, B.S., Ph.D., Professor of Mathematics, Columbia University. Appendix No. 8 in the Report of the Superintendent of the Coast and Geodetic Survey, 1902. Washington, 1903.

This bibliography extends from page 429 to page 787 of the *Report*. It was prepared in accordance with the request of the International Geodetic Association that a revised edition of the bibliography published in the Report of the United States Coast and Geodetic Survey for 1887 be issued. Only such works as treat directly of the figure of the earth, or such as describe operations which may be used in determining that figure, are included. In the case of the pendulum, however, "the theoretical side has also been included, in the belief that the pendulum will soon become a more important instrument, when it may be necessary to reconsider some of its theoretical features."

Vaterländische Handels-und-Verkehrsgeographie. By C. Grundscheid. viii + 179 pp. Hermann Beyer & Söhne, Langensalza, 1901.

This text-book of commercial geography is intended for commercial schools in Germany, and treats only of the mother country

and her colonies. The study is properly based upon the natural conditions affecting the production and distribution of commodities. In Part I the products of each geographic division, as the low plain of the Upper Rhine, the Baltic coast region, etc., are treated separately. Part II is devoted to a general survey of the industries and trade of the country as a whole. Part III deals with the colonies, and Part IV describes the chief raw materials imported from foreign countries. The topics, particularly the industries, are treated with unusual fullness for a text-book; but a school book on Commercial Geography limited to a single country misses the important educative element of comparison and contrast with other countries.

Hints to Travellers. Edited by John Coles, F.R.G.S., F.R.A.S. Eighth Edition, Revised and Enlarged. Vols. I and II. London, The Royal Geographical Society, 1901.

The present edition of this useful handbook has been expanded to two volumes. The first volume, entirely given to Surveying and Practical Astronomy, amplifies the earlier sections on Surveying, and includes a set of tables, by using which, with the Nautical Almanac, travellers may compute the results of their observations. In the second volume the sections on Meteorology and Medical Hints have been rewrittten and greatly enlarged; and Photography, Geology, Natural History, Industry, and Commerce, etc., have been revised. Hints on Outfit and other topics, formerly treated in the one-volume edition, are reserved for a separate pamphlet. Many explorers are compelled to limit the weight of their outfit. It is to be supposed that all suggestions most needed in their travels can be compactly presented within the present compass of this work, which still has the advantage of being lighter and smaller than some of the similar German handbooks.

The Restoration of the Ancient Irrigation Works on the Tigris; or, The Re-Creation of Chaldea. By Sir William Willcocks, K.C.M.G., M.I.C.E., Late Director-General of Reservoirs, Egypt, Managing Director of the Daina Sanieh Company. Being a Lecture Delivered at a Meeting of the Khedivial Geographical Society, Cairo, 25th March, 1903. With Two Appendices. Appendix A—Meteorological Information about Bagdad. Appendix B —An Address on "Egypt Fifty Years Hence." And Ten Plates. Cairo, National Printing Department, 1903.

Egypt is the queen of irrigated countries, but next to Egypt Sir William places the wonderful land irrigated in ancient days by

the Tigris, and he sees the resurrection of this region near at hand in the progress of the Bagdad Railway.

In ancient days there were two great systems of irrigation starting from above the final rapids of the Tigris—the Nahrwân system on the left bank, and that now known as the Dijeil on the right. In those days the Tigris was in its old bed, and the ancient Opis on its left bank bore to the delta of the river much the same relation that Cairo bears to the delta of the Nile.

These systems were magnificent, and the Nahrwân alone, when carrying its full supply, must have been capable of crippling the Tigris. Sir William declares that, for magnitude, the Nahrwân surpassed any Egyptian or Indian canal. The ruin that came upon the prosperous Chaldea was caused by the change in the course of the Tigris. With the completion of the Bagdad Railway will come the restoration of the canals and the creation of another Egypt.

Appendix A gives the temperature, wind velocity and direction, and rainfall at Bagdad for 1888, 1894, 1899–1902. The mean annual temperature ranges from 71.4 (Fahr.) in 1888 to 74.5 in 1901. The highest wind velocity is 10 miles per hour in February, 1888 and 1894, and the yearly mean for four years is three miles an hour. The rainfall was 8.4 in. in 1888, 22.2 in 1894, 3.6 in 1899, 5.7 in 1900, and 1.5 in 1901.

Sir William Willcocks is no prophet of evil. His vision of Egypt Fifty Years Hence reads like a description of the Golden Age with modern improvements, and among these two statues, one of Cecil Rhodes on the Equator, the other of Mr. Cope Whitehouse on the top of the Mesaigêga cliff contemplating the inland lake of 600 square kilometres, which will be one of the pleasure resorts of Europe.

The plates accompanying this interesting pamphlet admirably illustrate the story of irrigation on the Tigris.

Toscanelli and Columbus. Letters to Sir Clements R. Markham and to C. Raymond Beazley. With Introductory Note and Bibliography of this Controversy. London, 1903.—Toscanelli and Columbus. A Letter from Sir Clements R. Markham, K.C.B., and a Reply from Mr. Henry Vignaud. London, 1903.—La Route des Indes et les Indications que Toscanelli aurait fournies à Colomb. Lettre au Dr. Jules Mees, de Gand, qui pourra intéresser le Dr. Sophus Ruge, de Dresde, par Henry Vignaud, etc. Paris, 1903.

In these three pamphlets Mr. Vignaud reaffirms his convictions

on the subject of the Toscanelli letters and defends his position with ingenuity worthy of a better cause.

It is his misfortune to advocate a theory which must always remain, so to speak, in the clouds and beyond the reach of proof.

In his *Bibliography* in the first pamphlet he enumerates thirty papers and publications (exclusive of ninety-two minor notices) called forth in various countries in the past two years by the communications made by himself and M. de la Rosa to the Congress of Americanists in 1900, and by Mr. Vignaud's book on *Toscanelli and Columbus*. Most of these publications are favourable to the theory of the Columbus forgeries—a natural result in the case of every attempt to belittle a famous name. The spirit of the man who voted for the banishment of Aristides works in nine men out of ten; but the tenth man is not always silent, and for this reason Mr. Vignaud finds himself engaged in a controversy which he sustains with vigour, if not always with good taste. He says, for instance, on the second page of his *Bibliography*, that he made a *scorching reply* to a criticism by Signor Uzielli, who, it may be hoped, was provided with a pair of tongs. Again, Dr. Sophus Ruge is told on page 26 of *La Route des Indes* that he has but a slight acquaintance with the principles of historical criticism, and that by his intellectual culture, by the direction of his studies, and by the cast of his mind, he is incapacitated for appreciating the Portuguese and Spanish atmosphere, in which one must feel perfectly at home if he is to write anything that shall not be mere repetition about Columbus.

We cannot all do all things, and Mr. Vignaud seems to expect too much of those who are less happily endowed than himself.

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MAP.—[France] Manœuvres du Sud-Est en 1903. [Being portions of the Departments of Ardèche, Drôme, Gard and Vaucluse: apparently from the regular

Government survey.] Paris, Dépôt de la Guerre, 1903. *Scale:* about 1¼ miles = 1 inch. *Size:* 19½ x 33 inches.

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MAP.—Portugal, Carta Chorographica de. J. A. F. de Madureira Beça. Lisboa, Manual Gomes, 1901. *Scale:* 8 miles = 1 inch. *Size:* 27¾ x 36⅛ inches.

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MAP.—Portugal Ultramarino: India, Macau e Timor. B. A. Ligorne. Lisboa, Avellar Machado [1900?]. *Various scales. Size:* 25½ x 18½ inches.

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S. THOMAS, DOMINGO DE.—Arte de la Lengua Quichua. Publicada de nuevo por Julio Platzmann. Edicion facsimilar. Leipzig, B. G. Teubner, 1891. 16mo.

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BY GIFT.

From Alexander Agassiz, Museum of Comparative Zoölogy, Cambridge, Mass.:

Bulletins of the Museum of Comparative Zoölogy: Vol. XLII, Geological Series; Vol. VI, Nos. 2, 3, 4, 1903. Cambridge, Mass., Printed for the Museum. 8vo.

From the Railroad Commission of Texas, Austin, Texas:

Railroad and County Map of Texas, 1903. Austin, State R.R. Commissioners. *Scale:* 25 miles to 1 inch. *Size:* 34½ x 30¼ inches.

From F. W. Beer, Librarian of the Howard Library, New Orleans, La.:

Map of New Covington in St. Tammany Parish, La. P. L. Gusman, Surveyor. New Orleans, 1887. *Scale:* 8½ inches=1 mile. *Size:* 18¼ x 26⅝ inches. View of New Orleans taken from the Lower Cotton Press. Engraved on copper by B. Dondorf, Frankfort a/M. [N. Orleans] Louis Schwarz [1840?] *Size:* 26½ x 10¼ inches.

From the Allgemeiner Verein für Deutsche Litteratur, Berlin:

Herbsttage in Andalusien. Von Georg Wegener. Berlin, Allgemeiner Verein für Deutsche Litteratur, 1903. 8vo.

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Maps of the City of New York, surveyed under Directions of Insurance Companies of said City by William Perris. 1854–1859. [8 folio volumes of maps mounted on linen.]

From Verplanck Colvin, Superintendent State Land Survey, Albany, N. Y.:

Report of the Superintendent of the State Land Survey of the State of New York, March 9, 1897. New York and Albany, Wynkoop–Hallenbeck–Crawford Co., 1897. 1 vol. 8vo. With case of Maps.

From Hubert Droogmans, Secrétaire-Général du Département des Finances de l'Etat Indepéndant du Congo, Brussels:

Carte du Katanga (Territoires Gérés par le Comité Spécial du Katanga). Dressée par H. Droogmans. Exécutée par A. De Schaepmeester. [Bruxelles?] Juillet, 1903. *Echelle:* 1 centimètre pour 10 kilométres. [2 sheets, *size:* 37⅝ x 23¼; and 37⅝ x 21 inches, respectively.]

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Report by His Majesty's Commissioner on the East Africa Protectorate. [Parliamentary Paper] *Africa No. 6, 1903.* London, H. M. Stationery Office. 8vo.

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Cenni Storici sui Lavori Geodetici e Topografici e sulle principali produzioni Cartografiche eseguite in Italia. Dalla metà del Secolo XVIII ai Nostri Giorni. *Con 12 ritratti.* Firenze, Istituto Geografico Militare, 1903. pr., 8vo.

From Col. St. G. C. Gore, Surveyor-General of India, Dehra Dun:

The Great Trigonometrical Survey of India, Vol. XVII: Indo-European Arcs from Karachi to Greenwich. Major S. G. Burrard, Supt. Dehra Dun, Office of the Survey, 1901. 4to.

From Harper & Brothers, Publishers, New York:

Rise and Progress of the Standard Oil Company. By Gilbert Holland Montague. New York, Harper & Bros., 1903. 8vo.

From Eduardo Higginson, Consul of Peru, Southampton, England:

Map of the Republic of Peru. With a short description of the country, its Geographical features, etc. Under the Authority of Don Eugenio Larrabure y Unánue, Minister of Foreign Affairs. Compiled, etc., by Eduardo Higginson. Lima, 1903. *Scale:* 46 miles to 1 inch. *Size:* 28¾ x 36½. *Sheet, folded in cover.*

From A. Lahure, Publisher, Paris:

Voyage au Rio Curuá: 20 Novembre 1900–7 Mars 1901; Voyage à la Mapuerá: 21 Avril 1901–24 Decembre 1901; Voyage au Maycurú: 5 Juin 1902–12 Janvier 1903. Par O. Coudreau. Paris, 1903. 3 vols. 4to.

From Jules Leclercq, Author, Bruxelles:

Une Expérience Collectiviste à Java. *Extrait de La Réforme Sociale (16 Juillet, 1903).* Paris, Secrétariat de la Société d'Économie Sociale, 1903. pr., 8vo.

From Dr. W. H. G. Lewis, New York:

One Thousand Miles Up the Nile. By Amelia B. Edwards [New York] Aldine Publishing Co., s. a. 16mo.

From the British South Africa Company, London:

Southern Rhodesia: Information for Intending Settlers. (London), British South

Africa Co., pr., 8vo; Reports on the Administration of Rhodesia, 1901–1902 [with Maps] and Appendix (London, 1903), 4to.

From the British War Office, London:

Précis of Information concerning the Uganda Protectorate. London, H. M. Stationery Office, 1902. 8vo.

From Marsden Manson, Author, San Francisco, Cal.:

The Evolution of Climates. [Revised, enlarged and reprinted from the American Geologist, Aug.–Oct., 1898.] Minneapolis, The Franklin Printing Co., July, 1903. 8vo.

From Horace Marshall & Son, Publishers, London:

Ireland and Her Story. By Justin McCarthy. London, 1903. 16mo.

From the Surveyor-General of Victoria, Melbourne, Australia:

Map of Victoria, classified according to its productiveness. Melbourne, Crown Lands Department, 1901. *Scale:* 16 miles=1 inch. *Size:* 32⅞ x 23½ inches.—Map of Victoria, showing Counties, parishes and railways. Melbourne, Department of Lands, 1902. *Scale:* 8 miles=1 inch. *Size:* 62 x 43½ inches [4 sheets combined].

From Joseph Nimmo, Jr., LL.D., Author, Washington:

The Regulation of Commerce through a Dispensing Power. Efforts of the Interstate Commerce Commission to gain Autocratic Control of the Internal Commerce of the United States. Washington, D. C., R. H. Darby Printing Co., 1903. p., 8vo.

From the Department of the Interior, Ottawa, Canada:

Maps of the Districts of Saskatchewan and Assiniboia: James White, F.R.G.S., Geographer. Ottawa, 1903. *Scale:* 12½ miles=1 inch. *Size:* 42 x 22 (Saskatchewan); 39½ x 19½ (Assiniboia).

From T. Mitchell Prudden, Author:

Prehistoric Ruins of the San Juan Watershed in Utah, Arizona, Colorado and New Mexico. (Reprinted from the American Anthropologist, N. S., Vol. 5, pp. 224–288, April–June, 1903.) Lancaster, Pa.

From the Revenue Secretary, Government of Burma, Rangoon:

Gazetteer of Upper Burma and the Shan States. By J. G. Scott and J. P. Hardiman. Rangoon, Government Print, 1900–1901. 5 vols. large 8vo.

From F. R. de Rudeval, Editeur, Paris:

L'Évolution Comparée des Sables. Par Jules Girard. Paris, F. R. de Rudeval, 1903. 8vo.

From the Land Department of the Southern Pacific Railroad Company, San Francisco, Cal.:

Map of California, compiled from latest official and authentic information. San Francisco, S. Pacific R.R. Co., 1903. *Scale:* 24 miles=1 inch. *Size:* 21½ x 25½ inches.

From Charles Scribner's Sons, Publishers, New York:

Commercial Geography. By Jacques W. Redway. New York, 1903. 8vo.

From Smith, Elder & Co., Publishers, London:

A Search for the Masked Tawareks. By W. J. Harding King. London, 1903. 8vo.

From Anson Phelps Stokes, Author, New York:

Cruising in the Carribbean with a Camera. New York, Dodd, Mead & Co., 1903. 16mo.

From the Board of Railroad Commissioners, Topeka, Kansas:

Official Railroad Map of Kansas, 1902. *Issued by the State Board of Railroad*

Commissioners. Buffalo, N. Y., The J. N. Matthews Co. *Scale:* 14 miles to 1 inch. *Size:* 29¼ x 17¼ inches.

From Velhagen & Klasing, Publishers, Bielefeld und Leipzig:

Deutschland im Stillen Ozean. Von Georg Wegener. *Land und Leute, XV.* Bielefeld u. Leipzig, Velhagen & Klasing, 1903. 8vo.

From Henri Vignaud, Author, Paris:

La Route des Indes et les Indications que Toscanelli aurait fournies à Colomb. Lettre au Dr. Jules Mees, de Gand, qui pourra intéresser le Dr. Sophus Ruge, de Dresde. Paris, Ernest Leroux, 1903. pr., 8vo.

From the International Bureau of the American Republics, Washington, D. C.:

Map: Nicaragua. From Official and Other Sources. Prepared in the International Bureau of Am. Republics, W. W. Rockhill, Director. Washington, 1903. *Scale:* 12.5 miles to 1 inch. *Size:* 28 x 28½ inches.

From the War Department, Washington:

Map of the Department of Alaska. Projected and Compiled by order of Brig.-Gen. C. M. Randall, U. S. A., in the Engineer Office, Dept. of the Columbia, under the direction of Maj. W. R. Abercrombie, etc., by H. L. Gilbert, Jr., C. E. Washington, D. C., 1902. *Scale:* 50 miles=1 inch. *Size:* 33½ x 27 inches.

From Francis Wardlaw, Esq., New York:

Plan of Rome, containing its several additions from the time of Servius Tullius to that of its being taken by the Gauls. [London? 1800?] [Scale not given.] *Size:* 11¼ x 6¾ inches.—Pianta topografica della Città di Roma dell' anno 1836. Roma, Niccola de Antoni, 1836. *Scale:* 825 Palmi Rom.=1 inch. *Size:* 29¼ x 24½ inches.—Plan of Rome. London, John Murray, 1869. *Scale:* 7½ inches=1 mile. *Size:* 25 x 20½ inches.

From Sir William Willcocks, Author, Cairo:

The Restoration of the Ancient Irrigation Works on the Tigris, or the Re-Creation of Chaldea. . . . *Lecture delivered at a Meeting of the Khedivial Geographical Society, Cairo, 25th March, 1903.* Cairo, National Printing Department, 1903. pr., 8vo.

NOTES AND NEWS.

THE FIRST MEETING of the Society for the season of 1903–1904 will be held at Mendelssohn Hall, No. 119 West Fortieth Street, on Tuesday, November 17, 1903, at 8.30 o'clock, P.M.

Prof. E. L. Stevenson, of Rutgers College, will address the Society on Martin Waldseemüller and the early Lusitano-Germanic Cartography of the New World.

On the 15th of December Dr. Frederick A. Cook will describe his experiences in the Exploration and Attempted Ascent of Mount McKinley, in Alaska.

THE EIGHTH INTERNATIONAL GEOGRAPHIC CONGRESS.—Credit having been given in some quarters to the American Geographical

Society for arrangements connected with the forthcoming—or Eighth—International Geographical Congress, it is deemed best to state here that this Society is entitled to no credit and assumes no responsibility in the matter.

By a rule unanimously adopted at the Congress held in London in 1895 it was ordered that the governing body of each Congress should constitute an Executive Committee to choose, at its own discretion, the place for holding the next ensuing Congress.

In conformity with this rule, the Executive Committee of the Seventh International Geographical Congress, held in Berlin in 1899, selected Washington as the place of meeting of the Eighth Congress; and the responsibility for the organization and conduct of this—the Eighth—Congress naturally devolved upon the National Geographic Society of Washington, which has entered upon its duties with energy. It has appointed a Committee of Arrangements, which has had several meetings and is, doubtless, making good progress.

The Congress will assemble in Washington early in September, 1904. A preliminary announcement, giving details of proposed sessions, classification of subjects, excursions, etc., will be printed in the BULLETIN as soon as it is issued by the Committee of Arrangements.

The officers of the Committee are: Dr. W J McGee (Vice-President, National Geographic Society), chairman; Mr. John Joy Edson (President Washington Loan and Trust Company), treasurer; and Dr. J. H. McCormick, secretary. The office of the Committee is in Hubbard Memorial Hall, Washington, D. C., U. S. A.

It is announced that members of the Congress will be entitled to participate in all sessions and excursions, and to attend all social meetings in honour of the Congress; they will also (whether in attendance or not) receive the publications of the Congress, including the final Compte Rendu, or volume of proceedings.

Membership may be acquired by payment of $5 (25 francs, one pound, or 20 marks) to the Committee of Arrangements. Ladies and minors accompanying members may be registered as associates on payment of $2.50 (12½ francs, or 10 shillings, or 10 marks); they enjoy all privileges of members except the right of voting and of receiving publications.

THE ALASKAN BOUNDARY.—The Commissioners appointed under the Convention signed at Washington on Jan. 24, 1903, which provided for a Tribunal to consist of six impartial jurists of repute judi-

cially to consider and answer questions submitted to it and thereby settle the proper boundary between Alaska and Canada, made its award in London on Oct. 20, 1903. The award was signed by Lord Alverstone and the Commissioners of the United States. The Canadian Commissioners declined to sign it.

When the United States acquired from Russia in 1867 the whole of what was then known as Russian America it was acquired with all its existing lines of demarcation. The frontier fixed by the treaty of 1825 between Russia and Great Britain remained unchanged, the United States having merely succeeded to the territorial rights secured to Russia by that treaty. Unfortunately, the treaty abounded with geographical puzzles, and the United States and Canada could not agree upon their solution.

Was it the intention of the Russian negotiators to bar British territory from the tide-waters of the North Pacific by retaining a continuous fringe of mainland which should run around the head of every indenting arm and inlet? Were there any mountains in existence such as were postulated by the treaty? What precisely was Portland Channel, which was to form part of the southern extremity of the frontier? These problems were the chief of those presented by the questions which the Tribunal was called upon to answer.

The questions submitted to the Tribunal were answered, in brief, as follows:

The boundary line between Canada and Alaska begins at Cape Muzon, the southwestern point of the Prince of Wales Archipelago.

The line extends straight eastward from Cape Muzon across Dixon Entrance to the mouth of Portland Channel.

Portland Channel is that channel which extends to the ocean from about 55° 56′ N. Lat. and passes to the north of Pearse and Wales Islands. These long islands divide the adjacent waters into two channels, and the claim of the United States was that Portland Channel passed to the south of the islands, leaving them in Alaska. The Tribunal decided against this contention, and gave the two islands to Canada; but it further decided that the mouth of Portland Channel is Tongas Channel, between Wales and Sitklan Islands. Thus the two small outlying islands, Sitklan and Kannagunut, are assigned to Alaska.

The line, passing through Tongas Channel, proceeds up the middle of Portland Channel to its northern terminus in about 55° 56′ N. Lat., and thence north between Salmon and Bear Rivers, which empty into the head of Portland Channel, to the 56th parallel.

The greatest point of dispute was whether the treaty of 1825

meant that there should remain in the exclusive possession of Russia a continuous fringe or strip of coast on the mainland, not exceeding 10 marine leagues in width, separating the British possessions from the bays, ports, inlets, havens, and waters of the ocean (the United States contention); or whether the coast mentioned in the treaty should be defined to be that of the general trend of the mainland shores without taking account of the deep inlets, the line crossing these inlets parallel with the trend of the main coast (the Canadian contention) and leaving the heads of the inlets with all their harbours in the possession of Canada. The Tribunal decides this question in favour of the United States, the line fixed being parallel to the sinuosities and not the main trend of the coast, thus leaving the entire water front in the possession of the United States.

The United States contention, further, was that the so-called Vancouver range of mountains north of Portland Channel designated by the treaty of 1825 as the boundary wherever it was not more than 10 marine leagues from the coast does not exist, and therefore was eliminated as a part of the boundary. The Tribunal decided against this contention. It indicated certain mountains between the Taku River and Mt. St. Elias as the mountains referred to in the treaty; but in the south, between the neighbourhood of the Taku River and about 57° 20′ N. Lat. the Tribunal expressed its inability, in the absence of further surveys, to indicate the mountains parallel with the coast within the meaning of the treaty.

The effect of this decision is to bring the boundary from Portland Channel to Mt. St. Elias considerably nearer to the coast than the line represented by the extreme United States claims. This part of the boundary, however, cannot accurately be designated on a map until the line has been delimited by a joint survey in accordance with the interpretation of the treaty of 1825 now given by the Tribunal.

THE FOURTEENTH SESSION of the International Congress of Americanists will take place in Stuttgart from Thursday, August 18th to Tuesday, August 23, 1904.

The subjects to be discussed by the Congress relate to:

(*a*) The Native Races of America: their Origin, Distribution, History, Physical Characteristics, Languages, Inventions, Customs, and Religions.

(*b*) The Monuments and the Archæology of America.

(*c*) The History of the Discovery and Occupation of the New World.

Membership is acquired by the payment of 12 marks (3 dollars or 15 francs) by postal money order or by check, payable to the treasurer of the Committee of Organization,

MR. THEODORE G. WARNER,
Stuttgart, Königstrasse 35.

Members have the right to vote, are admitted to all the general arrangements of the Congress, and receive the publications gratuitously.

The languages of the Congress are English, German, French, Italian, and Spanish.

MR. FRANCIS H. NICHOLS, favourably known by his work, *Through Hidden Shen-si*, published last year, is now in Western China, continuing the exploration so successfully begun in the Province of Shen-si. The American Geographical Society was able to extend some aid towards his present expedition; and it is hoped to publish in the BULLETIN, from time to time, brief notices of his observations and progress. The last letter received from Mr. Nichols was written at Chung-King, in the Province of Süchwan, on the 4th of September. He had just arrived, after a toilsome and perilous voyage of 29 days through the gorges of the Yang-tsze at the season of high water, when the current of the great river runs ten or twelve miles an hour, and the boat must be pulled up-stream along the bank.

NAMES IN THE ARCTIC.—*Science*, of October 16, publishes the following communication from Mr. Edwin Swift Balch:

TO THE EDITOR OF SCIENCE: The president of the Royal Geographical Society, Sir Clements R. Markham, in the *Geographical Journal* for July, 1905, Vol. XXII., page 7, note, says: "The land which is divided from Greenland by Smith Sound forms a long island, and as many as seven names have been given to various parts of it—1. North Lincoln, 2. Ellesmere Land, 3. King Oscar Land, 4. Schley Land, 5. Arthur Land, 6. Grinnell Land, 7. Grant Land. It is a geographical necessity that, for purposes of description, there should be a name for the whole island. It was first discovered by Baffin in 1616, and first named Ellesmere by Inglefield in 1853. Its name should, therefore, be Ellesmere Island." A map on page 57 of the same volume shows "Ellesmere Island" and omits "Grinnell Land" and "Grant Land:"

It seems desirable to call the attention of American scientists and geographers to this curious proposition, which, without the slightest notice to American geographers, eliminates the American names given to the most important discoveries by Americans in the Arctic, and minimizes as much as possible any recognition of the work of Kane, Hayes, Hall, Greely and Peary.

EDWIN SWIFT BALCH.

PHILADELPHIA, October 6, 1903.

A GEOGRAPHICAL LIBRARY FOR SALE.—M. H. Welter, 4 rue Bernard-Palissy, Paris, has come into possession of the library of the late Vivien de Saint-Martin, who died in 1897 at the age of 95 years. The collection consists of more than five thousand volumes of works on geography, history, ethnography, anthropology, etc. It was assigned by M. Vivien de Saint-Martin during his lifetime in trust to his publishers, Messrs. Hachette & Cie., for a yearly income of 6,000 francs, which was paid to him for twenty-three years.

The library is to be sold, if possible, as a whole, and the price asked for it is 21,000 francs. A catalogue will soon be issued.